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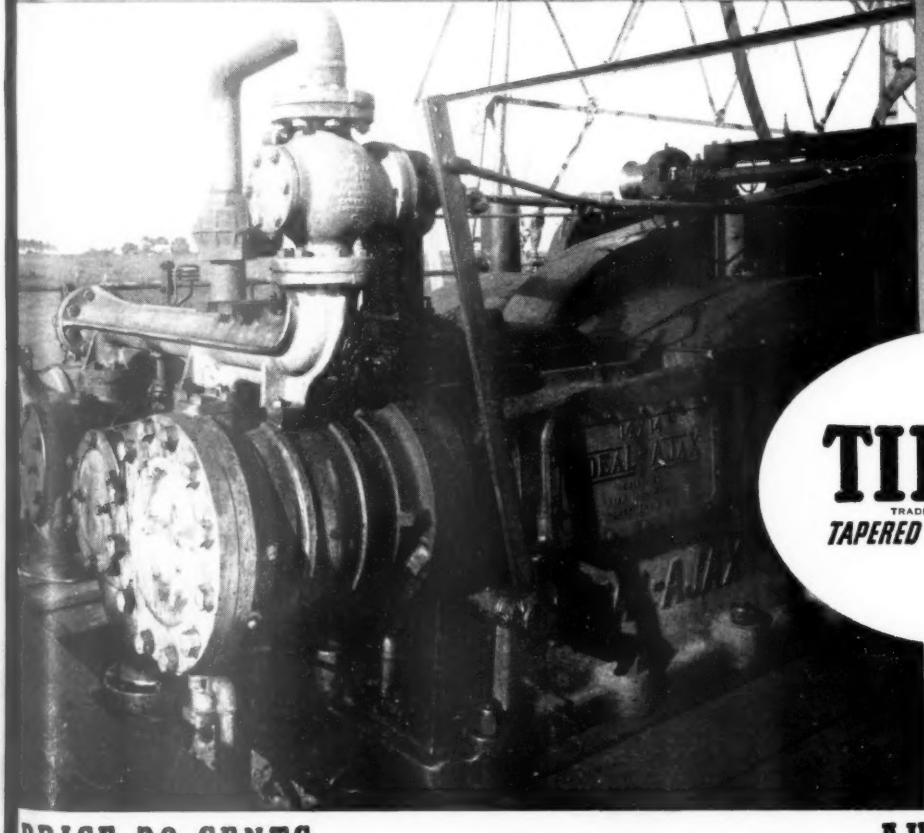

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the OIL AND GAS JOURNAL

Trends

Crude-Oil Production By States—Page 126

CRUDE-OIL STOCKS 222,931,000 bbl. as of Aug. 5—down 2,181.000 bbl. One year ago 237,382,000 bbl.

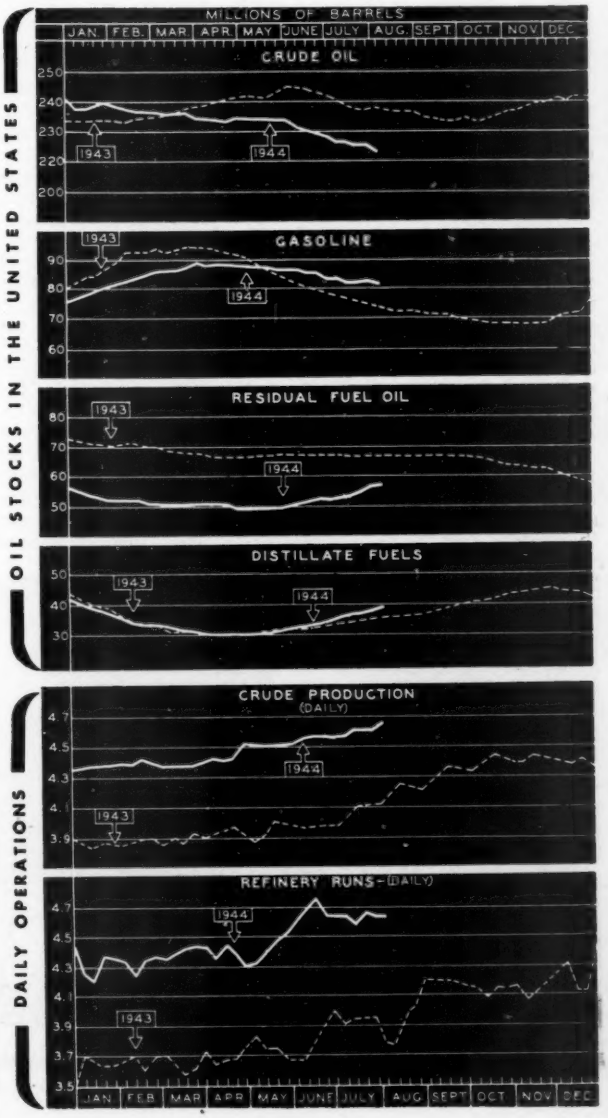
GASOLINE STOCKS 80,801,000 bbl. as of Aug. 5—down 1,864,000 bbl. One year ago 71,927,000 bbl.

RESIDUAL FUEL-OIL STOCKS 56,755,000 bbl. as of Aug. 5—up 470,000 bbl. One year ago 67,091,000 bbl.

GAS OIL AND DISTILLATE STOCKS 39,410,000 bbl. as of Aug. 5—up 1,275,000 bbl. One year ago 34,414,-000 bbl.

CRUDE-OIL PRODUCTION 4,656,100 bbl. daily average week ended Aug. 12—up 39,700 bbl. Year ago 4,258,600 bbl.

REFINERY RUNS 4,529,000 bbl. daily week ended Aug. 5—down 98,000 bbl. Year ago 3,810,000 bbl.



REPORTS from every war front reveal that the bombing of oil fields, refineries, synthetic plants and terminals has been particularly effective over the past month. These air raids are being supplemented with the actual capture of important petroleum facilities of the Axis with additional acquisitions in the offing. Germany has been generally credited with a petroleum supply of 300,000 to 350,000 bbl. daily, including substitutes. The most important sources are in Romania, centering in the Ploesti area. These properties including the production of approximately 100,000 bbl. daily of crude oil have been bombed repeatedly. The synthetic plants in Germany, Austria and Hungary have been the targets of new bombing methods which are believed to have completely destroyed several of the plants. Their output is estimated at 100,000 to 150,000 bbl. daily.

POLAND is credited with 19 refineries having a crude-oil capacity of 23,000 bbl. daily. This capacity is more than double the country's prewar production of crude oil. The two principal refineries, at Drohobycz, one with a capacity of 3,000 bbl. daily and the other with a capacity of 3,500 bbl. daily have been recaptured by the Russians who also now have the plants in the Lwow area. The Galician oil fields are now being placed back on production by the Russians. While the total output is under 10,000 bbl. daily its location is particularly important to the Russians.

IF the recent successes in France continue, the Allies will have retaken most of the refineries in France before the end of August. That country had 19 operating refineries previous to the German invasion in 1940, with a total capacity of 151,550 bbl. daily. The principal refining centers were in the south Mediterranean ports and in the general area of which Paris is the center. The largest plants are at Gonfreville, Martigues, Berre, Dunkirk, Port Jerome, and Rouen. These plants were modern, and it is understood that the Germans refined Romanian and other crudes at some of the plants which were not destroyed by the French at the time of the German invasion. In the East Indies this country's armed forces have started the bombing of the oil properties which have been partially rehabilitatedd by the Japanese and air raids have been made on the refineries located in Japan.

Leaders of Industry See Anglo-American Agreement as Preliminary Step Only

THE Anglo-American oil agreement, signed in Washington August 8, has evoked few unqualified expressions among leaders in the petroleum industry. The accord, salient features of which were published in The Oil and Gas Journal of August 12, on Page 52, is viewed for the most part, not as a conclusive step, but as one preliminary to broader action by the International Petroleum Commission, which is to be created under authority of the pact.

Comment of a more definite character is expected to be heard when the personnel of the commission is known and its duties are more specifically defined.

"A constructive step," said W. S. S. Rodgers, chairman of the board of The Texas Co. But he added that the helpfulness of the agreement would depend upon "the spirit in which it is interpreted by the two governments."

Both Wallace E. Pratt, vice president of Standard Oil Co. (New Jersey), and Col. Ernest O. Thompson, of the Texas Railroad Commission, pointed out that the pact incorporates the principles of the Interstate Oil Compact, which has been in operation since 1935. "If it will work between states, it will work between nations," said Colonel Thompson.

Senator Tom Connally, chairman of the Senate foreign relations committee, said the pact "assures this nation retention of oil reserves in the Middle East."

"Success of the agreement depends largely on the membership of the International Petroleum Commission to be set up under the agreement," said Ralph T. Zook, president Independent Petroleum Association of America.

The agreement will not go into effect until the two governments notify each other that they are prepared to operate under it. In the case of the United States this may or may not mean after approval by Congress, and it is understood that the British Government intends to submit the agreement to Parliament.

Question Left Open

The State Department left open the question of whether the agreement is a formal treaty, which must be ratified by the Senate, or is simply an "executive agreement," requiring no congressional action except appropriation of whatever funds may be required to carry out its provisions. Possibly the Senate committee on foreign relations may decide whether or not to submit it to the Senate for ratification.

The agreement is designed as a framework for international cooperation in orderly development and marketing of other commodities, and may set a general pattern. Other oil-producing nations are to be invited to a general conference for the adoption of this or a similar agreement for world-wide application. Meantime, this agreement will become the basis for United States and British foreign oil policy whenever it is put into effect.

The basic provision is creation of an International Petroleum Commission, with four members appointed by each government, to function permanently and continuously to study world petroleum conditions and make recommendations for action by the two governments. Both governments pledge themselves to use all constitutional means to require their nationals operating abroad to adhere to such recommendations as are adopted officially. Thus much may depend on the caliber of the men appointed to this commission.

In a sense the agreement contemplates world-wide proration, in that oil development is to be conducted in an orderly manner, with regard to market demands and to the economic welfare of the producing area.

Things Left Out Important

Perhaps what is not in the agreement is as important as what is in it, considering some of the proposals understood to have been contemplated. There is no provision for government ownership of petroleum facilities, nor for government participation in foreign oil activities. Nor does the agreement appear to imply the establishment of a cartel with price fixing and close division of markets. The commission presumably will suggest production quotas and area demands, but there would appear to be left a wide field for the play of competition among private oil companies.

United States oil men were notably absent from the discussions leading up to the agreement, and if they are ignored in the membership of a world commission set up to advise them on their operations it is believed they will enter protests.

One interpretation that could be placed on their exclusion is that it would be a step toward government regulation. There is a closer relationship between the oil industry and government of Great Britain than there is in the United States so that a wholly government personnel delegation from that country would be more representative of its oil industry than such a delegation from this country.

The commission has been mentioned as an instrument of peace,

Edward Stettinius, acting secretary of state, and Lord Beaverbrook signing the Anglo-American oil agreement

and the assumption has been made that it would deny oil to aggressor nations. Such action would affect only those countries which do not have sufficient domestic supplies to wage war. Exceptions could include Russia, Argentina and all those countries which do have internal sources of supply. The aggressor nations of the past are not necessarily those of the future.

If it can be shown that such an accord will promote international welfare, the oil industry of the United States undoubtedly will give it its enthusiastic support. However, the oil industry in the past has provided ample supplies at fair prices to all countries. It has developed new reserves as they were needed and it has experienced periods of excess supply and weathered them. This has been done without an international compact, so that the need for one in these respects is not apparent. The only clear gain to the domestic industry may be the opportunity of equal access. It is believed this could be obtained if it received the full cooperation of the State Department. These results have been attained through the free enterprise system and if the international agreement is found to contain a threat to this system, it will encounter opposition.

Oil Discovery in United States Stalled by Its Own Success

DISCOVERY of new oil reserves in the United States has been stalled by its own success, declares Wallace E. Pratt, geologist and vice president of Standard Oil Co. of New Jersey, in the current issue of the Journal of Business, published by University of Chicago School of Business. Discovery, he says, has lowered the price for crude oil and so weakened incentive for new ventures. "The search for oil reserves is a self-extinguishing enterprise; unless the principles of conservation are invoked to protect the natural consequences of its own success, it smothers itself before the reserves it proves are as large as our needs require."

Our proved reserves should be equal to 20 years' requirements, and we should not remove more than about one-twentieth of the total from the average reservoir in any one year, says Pratt. Sprees of oil-removal in the first years of a well's life make the last remaining supplies largely unrecoverable. To prevent this, oil companies must share the market ratably and press for new fields at all times.

"For the comprehensive development of the petroleum resources of the earth there is needed the same freedom for individual enterprise to explore, world-wide, that Americans have always enjoyed. This means an open-door policy among nations and the relinquishment by governments of their petroleum monopoly. There is needed, also, an organization of petroleum-exporting nations analogous to our own Interstate Oil Compact."

"It is hardly conceivable (unless wars are to continue unceasingly) that the United States will suffer a critical shortage of liquid fuels within the foreseeable future," Pratt declares.

Governments, however, should establish international commissions to set up quotas for individual nations in order to conserve proved reserves. Such prorating has been undertaken in the United States by the Interstate Oil Compact, making it possible to build up this nation's proved petroleum reserves from 4,500,000,000 bbl. in 1926 to 20,000,000,000 bbl. in 1943. Our peacetime consumption is 1,300,000,000 bbl. a year.

(Note: The British-American pact, setting up such a commission, was signed several weeks after Pratt wrote his article.)

The most promising parts of the earth in which to search for petroleum are the Near and Middle East in the Old World, the environs of the Gulf of Mexico and the Caribbean Sea in the Western Hemisphere; the Dutch and British East Indies in the Far East; and the land fringing the Arctic Sea in North America, Europe and Asia.

"Only the forward-looking Russians have made much effort to explore the petroleum possibilities of the Arctic."

The American Government should keep "hands off" in the Middle East, where it has been suggested that the Government build a "Big Inch" pipe line from Saudi Arabia to the Mediterranean. Such action might handicap American private enterprise in the Middle East, which has 30 per cent of the proved oil reserves of the world, and destroy the local tradition of no political ambitions which our Government has enjoyed.

Three Nations Confer On Rubber Problems

WASHINGTON.—Delegations from the United States, Great Britain and The Netherlands have finished preliminary conversations in London on postwar rubber problems, the State Department discloses. A first program of studies was prepared, and arrangements are being made for carrying out the studies, which are based upon a comprehensive survey of both natural and synthetic rubber and related problems.

The future of world rubber and the problems surrounding it, the official announcement of the conversations pointed out, are matters of common concern to the three governments. How best to bring about continuing examination and further discussions of the problems likely to arise concerning rubber and rubber substitutes was one subject considered, and it was agreed to resume the tripower conferences in the near future.

This meeting of American, Dutch and British government officials and industry representatives follows somewhat the pattern set by the agreement between Great Britain and the United States on an oil policy. Britain and the United States are also working out a joint aviation program. In rubber it is thought that some type of world agreement is again the objective.

For the first time, the United States has its own rubber industry in a synthetic capacity already equaling nearly the world export of natural rubber before the yar.

British and Dutch natural-rubber production is expected to be restored in a large degree when the Japanese are driven out of the East Indies and Malaya, and there is some natural rubber now in production in South America. Some international trade regulation to keep postwar rubber economy in balance is considered to be the objective of the present conferences.

Shell Pushing Development In Jack County, Texas

WICHITA FALLS.—Shell Oil Co., Inc., which is pushing its development program in Jack County, North Texas, has taken another big block of acreage in the county, comprising approximately 2,000 acres in the extreme south central part of the county north of Barton's Chapel and to the west of the community.

The block offsets to the south the old Roxana Petroleum Corp. 1 Williams, completed in 1922 for a 452-bbl. well from the Marble Falls from 4,557 to 4,562 ft., and which today is flowing from 5 to 10 bbl. of oil.

Regulations on Stripper-Well Adjustments Issued by DSC

Conform With Subsidy Plan Already Outlined by OPA

WASHINGTON.—Defense Supplies Corp. has issued its regulations on stripper-well compensatory adjustments under which it will pay first purchasers of crude oil the premium prices approved by Office of Price Administration for designated high-cost fields. The regulations, dated August 7 but effective as of August 1, conform with the stripper-well subsidy plan as outlined by OPA, with the addition of a provision that if the purchaser pays less than the OPA ceiling price for crude the subsidy will be reduced by a like amount.

Claims for payment are to be filed with the DSC in Washington for purchases made during a single calendar month, and claims must be filed by the twentieth of the second month following the month covered by the claim.

Special forms for filing claims and supporting information are being prepared by DSC. It is planned to have four forms. The first will be a simple claim form showing the amount of money the purchaser is demanding from DSC each month. Supporting this will be a form showing how the claim was calculated and giving information on the quantity of oil purchased from each pool or area during the month. The third monthly form will show the quantity of oil purchased during the month from each lease or property unit within each pool or area eligible for the subsidy.

The fourth form under consideration would be filed only with the first claim for subsidies in any pool, and it would show production from each lease or property unit for each pool for each of the preceding 12 months, together with the total and the month average. For purposes of its bookkeeping, DSC plans to institute a system by which a code number will be assigned to each purchaser, state, county, pool and lease, and after these numbers are assigned all crude purchasers will be expected to use them on their forms.

Submission of production data by leases was not contemplated by OPA when the subsidy plan was conceived, but was considered necessary by DSC as a check on the operation of the plan and to make sure that the subsidized premium payments go only to producers within the pools designated by OPA. At one time during the drafting, DSC proposed to word the regulations so that the subsidy would cease whenever a field increased its average production above 9 bbl. per well, but this was opposed by the industry and by OPA on the ground that the chief excuse for the subsidy was to promote production and furnish an incentive for rehabilitating old fields.

Concerning the method of filing claims and their payment the regulations provide:

Filing Claims for Compensation

(a) **Place of filing.**—Claims shall be filed with Defense Supplies Corporation, 811 Vermont Avenue, Washington 25, D. C., or at such other place or places as may from time to time be designated by DSC.

(b) **Time of filing.**—Claims shall be filed not later than the 20th day of the second calendar month following the month covered by the claim.

(c) **Form of claim.** — A separate claim shall be filed for each calendar month. All claims shall be filed in triplicate on forms approved by DSC and in accordance with the instructions on such forms and shall be accompanied by such documents, data and information as may be required by DSC.

Inspection and Payment of Claim

(a) If DSC determines that a valid claim has been filed within the provisions of this regulation, then DSC will pay to the applicant the amount thereof. Payments of claims will be made only to applicants; DSC will not recognize assignments of claims by applicants to other parties.

(b) DSC may at any time make or cause to be made an examination or audit of any books, records and other supporting data as it may deem necessary to verify further the validity and correctness of any claim hereunder.

(c) If any claim which has theretofore been paid is found incorrect upon examination or audit, then the amount of such payment shall be due and payable to DSC and shall be returned to it upon demand and without limitation of any other rights accruing to DSC. No further advances or payments shall be made to such applicant until such deficiency has been returned.

(d) Should any claim be rejected in whole or in part or should any applicant desire an interpretation of this regulation, the applicant may request DSC to reconsider its action or issue an interpretation. If the request is in connection with a rejected claim, it must be filed within 30 days after such claim is rejected. Such request shall be addressed to Defense Supplies Corporation, 811 Vermont Avenue, N. W., Washington 25, D. C., and shall state clearly and concisely the questions involved and the applicant's views thereon. If DSC finds justification for reopening the claim it shall so notify the applicant and the latter may thereupon submit a new claim which shall be processed in the same manner as though submitted within the required time. Upon the announcement of any decision or interpretation issued hereunder any applicant may within 30 days apply to DSC for the right to modify or revise any claims theretofore filed which are affected by such decision or interpretation and which accrued within the period of 90 days immediately preceding the first of the month following the date when the decision or interpretation was announced.

General Motors Corp. Will Open Office in Tulsa

General Motors Corp. will open a branch office of the Detroit Diesel Engine division in Tulsa, according to an announcement by R. K. Evans, vice president of General Motors. The Tulsa office will handle the distribution of the company's diesel engines throughout the petroleum industry.

A. F. CAMPBELL

Arch F. Campbell, long identified with the oil industry and the petroleum-equipment field, has been appointed manager for oil-country sales and distribution. Campbell is a graduate of University of Michigan and was a flying officer in World War I. He has served as branch manager of Waukesha Motor Co., sales manager of the Superior Engine division of National Supply Co., and more recently was associated with Clark Brothers Co., Inc., division of the Dresser Industries.

THIS WEEK

PRODUCTION—National daily crude output for week ended August 12 hits all-time high of 4,656,100 bbl. . . . Previous record was 4,616,400 bbl., week ended July 22. . . . Cumulative production for year passes billion mark, 1,007,993,450 bbl., compared with 887,173,800 bbl. same period last year. . . . ¶World's deepest producer, well in Terrebonne Parish, Louisiana, gaged; shows potential of 648 bbl. . . . Perforations at 13,498-13,503 ft. . . . ¶Important production from levels formerly regarded as without commercial possibilities now foreshadowed by definite proving of intermediate deep-pay zone yielding heavy flush production, in Andrews County, Texas. . . . ¶Joseph E. Pogue, advisory staff of PIWC, predicts that Mississippi, now twelfth among oil-producing states, will probably take "seventh if not sixth place" in 3 years. . . .

DRILLING—Operating company, developing Elk Hills for Navy, sets mark at completion of a well a day till program is finished. . . . Hopes to have 15 strings running. . . . One company has 31 rigs running in Kansas; 15 are wildcat operations. . . .

INTERNATIONAL—Most oil leaders withhold comment on Anglo-American pact pending further opportunity of studying its practical values. . . . Inclined to view it favorably, with qualifications. . . . Regarded generally as preliminary to functioning of International Petroleum Commission which it sets up. . . . Much depends on personnel of commission and specific definition of its duties. . . . ¶United States, Great Britain and the Netherlands hold conference on postwar rubber problems. . . .

REFINING—PIWC says amazingly powerful aviation gasoline will be produced as soon as military plans for its use are completed. . . . Volatility of new fuel and other characteristics having to do with performance stressed. . . . Several refining companies report unusual performance records in the production of 100-octane gasoline and other war products. . . . Crude runs to stills which have shown a tendency to level off over the past month will be further expanded if plans of the governmental agencies are carried out. . . .

TRANSPORTATION—Shortages of tank cars, tank trucks and heavy-duty tires have created "national crisis" in transportation, director of ODT declares. . . . ¶Civilians warned to lay in fuel-oil supplies while deliveries still can be made. . . .

BOMBINGS—Superfortresses blast Pladjoe refinery at Palembang, largest in Orient and important source of aviation gasoline. . . . Believed to have been operating near prewar capacity. . . . ¶American heavy bombers strike fuel and transport facilities around Paris and big Romanian oil center of Ploesti. . . . Refineries, tank cars and derricks left flaming. . . . ¶More than 1,000 bombers and fighters attack objectives around Stuttgart, "Detroit of Germany." . . . ¶German synthetic oil refinery near old Polish capital of Krakow bombed. . . .

Located in a tidal marsh area in Lafourche Parish, Louisiana, about 30 miles south of New Orleans, the Delta Farms field, like many other fields of the Gulf Coast, is accessible only by water. Dredged canals link locations of the various wells, which are drilled from barge-mounted rigs. In the accompanying picture are shown H. D. Collier (center facing camera), president of the Standard Oil Co. of California, and other officials of that company and its subsidiary, the California Co., operator in the field, during a recent inspection trip of the properties

Low Octane Rating for Civilian Gasoline Helps War Effort

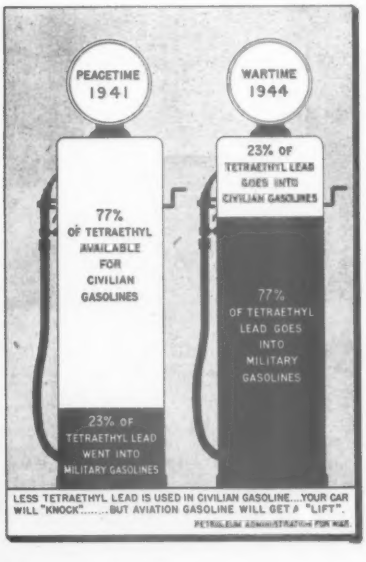
WASHINGTON.—Recent reductions in the quantity of tetraethyl lead going into civilian premium and housebrand gasolines are estimated to save enough lead to produce 210,000,000 gal. of 100-octane aviation gasoline each month, according to Deputy Petroleum Administrator Ralph K. Davies.

Reduction of regular, or housebrand, gasoline from 72 to 70 octane should save enough tetraethyl lead to manufacture 120,000,000 gal., Davies said, adding that reduction in the quantity of premium gasoline manufactured probably will save an additional 90,000,000 gal.

Tetraethyl lead is used in the manufacture of most gasolines to increase the octane rating and give the motor fuel antiknock qualities. It is even more important in the manufacture of aviation gasolines and therefore has been diverted into that channel.

The extent to which the military requirement for gasoline dominates the use of tetraethyl lead is indicated by the fact that the quantity of tetraethyl lead used for civilian gasoline manufacture has dropped 54 per cent since 1941. This is illustrated in the accompanying chart released by Petroleum Administration for War.

The chart shows that during 1941 about 77 per cent of the total tetraethyl lead manufactured was available for civilian gasoline, and the remaining 23 per cent in the various grades was used by the military. War-time needs have completely reversed the use of tetraethyl lead, and now military gasoline requirements consume 77 per cent and civilian gasoline may absorb 23 per cent.


PEACETIME 1941
77% OF TETRAETHYL AVAILABLE FOR CIVILIAN GASOLINES
23% OF TETRAETHYL LEAD WENT INTO MILITARY GASOLINES
WARTIME 1944
23% OF TETRAETHYL LEAD GOES INTO CIVILIAN GASOLINES
77% OF TETRAETHYL LEAD GOES INTO MILITARY GASOLINES
LESS TETRAETHYL LEAD IS USED IN CIVILIAN GASOLINE...YOUR CAR WILL "KNOCK"..... BUT AVIATION GASOLINE WILL GET A "LIFT".
PETROLEUM ADMINISTRATION FOR WAR.

"The unprecedented requirements for aviation fuel calls for the use of greatly increased quantities of tetraethyl lead at a time when production and stocks of this product are far from adequate," Davies said. "If and when military requirements are attained, it may then be possible to restore civilian grades of gasolines to their former quality levels but our first duty is to keep the military supplied in full."

As a result of the lowered octane number of regular gasoline, refiners' maximum prices have been established by Office of Price Administration at ⅛ cent below the applicable maximum price in effect on 72-74 octane gasoline at each shipping or delivery point. There will be no change in tank wagon ceilings or at retail.

Leaded gasoline of 70 octane is a new product for most if not all refiners. Gasoline sold at the tank-wagon level as "regular grade" has traditionally fallen in the 72-74-octane bracket. The reduction in the octane rating of regular grade gasoline to a maximum of 70 was made under a directive of PAW, which prohibited production of leaded gasoline in excess of 70 octane A.S.T.M. for distribution as regular grade in order to conserve supplies of tetraethyl lead needed to produce aviation and all-purpose gasoline for the armed forces.

Intensified Bombings Cripple Enemy Oil Installations

LONDON. — Intensified bombings of oil installations during the past week have helped greatly to hasten the end of enemy resistance.

Superfortresses of America's Twentieth Bomber Command, striking at the nerve center of Japan's war machine on August 10, blasted the great oil-refining area of Palembang, on the island of Sumatra.

The Pladjoe refinery at Palembang is the largest in the Orient, and is believed to have been operating at or near its prewar capacity of 18,000,000 bbl. of crude a year. It is an important source of aviation gasoline.

On the same day fleets of American heavy bombers from England and Italy struck at fuel and transport facilities around Paris and, for the second time in a dozen hours, at the great Romanian oil center of Ploesti.

Upwards of 500 Flying Fortresses and Liberators, escorted by Mustangs and Lightnings, started fires licking at the refineries, tank cars and derricks 35 miles north of Bucharest. Some installations 19 miles northwest of Ploesti also were bombed in this thirteenth attack from Italy on the major spring of Nazi oil.

The Germans used smoke screens, causing the fliers from Italy to bomb by instrument. Several enemy fighters were destroyed after the armada broke through a screen of interceptors and loosed their explosives in a storm of intense flak.

In one of their increasingly frequent daylight raids, big four-motored British Lancasters joined in the campaign to wipe out the fuel supply of the German war machine, attacking an oil storage depot at Dugny, adjoining the Lebourget airfield near Paris on the afternoon of August 10. All of the bombers returned. Fuel dumps in the vicinity of Paris were hit from Britain by a force of some 250 Liberators with a Mustang escort.

More than 1,000 U. S. heavy bombers and fighters attacked objectives around Stuttgart, the "Detroit of Germany," August 9 and Berlin reported another fleet was striking at Hungary from Italian bases.

Twice within 3 hours on August 8, RAF Lancasters and Halifaxes attacked three fuel dumps in northern France—all considerable distances from the battle front and containing hundreds of tons of oil. All three dumps—at Aire-Sur-La Lys in the Pas-De-Calais area, in the Foret De Lucheux to the south and in the Foret De Chantilly just north of Paris—were left in flames.

The American Eighth Task Force bombed a German synthetic oil refinery at Tresbinia, about 20 miles west of the ancient Polish capital of Krakow. Crews reported excellent visibility, with fires and explosions in the target area. The aerial task force reached Russian bases from England after bombing an enemy aircraft plant in the Polish corridor northwest of Gydnia.

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Workable World Pattern

THE Anglo-American oil pact signed last week by representatives of the United Kingdom and this country should be understood to be what it is—a declaration of intent on the part of the largest two oil-producing nations. As a statement of general policy it includes most of the features suggested by the oil industry's leaders in recent months.

The proof of what can actually be done in international collaboration in the production and distribution of this most essential world commodity will come when the present pact is superseded, as promised, with a multilateral oil agreement involving all nations. Obviously, any oil program must be part and parcel of the treaty of nations at the conclusion of this war if this greatest of all conflicts is to accomplish its primary objective of an enduring peace. Equally apparent is the fact that no agreement affecting this nation's future so vitally as does petroleum will receive the legislative approval provided by the Constitution until its final terms are generally understood by millions of consumers.

There should be no delusions as to the difficulties ahead in arriving at a practical world oil program for the postwar period. Based on operations immediately preceding this country's entry into the war there were 25 countries producing crude oil. Only 19 produced oil in excess of their own requirements and the bulk of exports came from six countries. The 10 leading countries produced 85 per cent of the world's total oil supplies, five produced 79 per cent, and one—the United States—62 per cent.

The countries with part or all of their own petroleum supplies have only one third of the world's population. This means that approximately 1½ billion people must look to other nations for their petroleum. Additional millions are dependent on outside sources of supply for certain essential products of petroleum.

Furthermore, there are matters of national policy which are possible obstacles in the accomplishment of international objectives. Some governments have taken the position in the past that petroleum products except in the maintenance of national defenses and in limited industrial uses are a luxury which should not be made generally available to their peoples. The results of this policy are prohibitive taxes and many restrictions applying to the distribution of petroleum products.

The pact recognizes this and other governmental obstacles in its declaration of principles looking to the adoption of a satisfactory program which will assure that the world's adequate petroleum supplies are universally available at prices which will contribute to the economic advancement of all nations.

As to a workable pattern for world oil development this country's 85 years of progress should be controlling in the plans of all nations. Founded and steadily expanded as a free enterprise this country's oil industry has accounted for more than 60 per cent of the world's supply and demand.

In an emergency operators in this country have increased their percentage of the world's total output to approximately 70 per cent including all but a small part of those special products which are winning a war for the Allies. This record should provide the answers to those outside the oil industry in this and other countries who conceive of a world oil plan in terms of international cartels and other agreements implemented with strict national ownership or controls.

Development Program at Elk Hills in Full Swing

by L. P. Stockman

IN conformity with a recent agreement, Standard Oil Co. of California and the Navy Department are working industriously to drill sufficient new wells in 10 months to build up daily production of Elk Hills to a sustained maximum of 65,000 bbl. Standard of California is doing the development work on an actual cost basis, with no allowance for general overhead or the incorporation of any outside charges.

Relations between Standard employes and Navy personnel are cordial. To facilitate operations, a two-man committee has been set up, with full jurisdiction over field procedure. Comdr. Harry P. Stolz, a petroleum engineer, represents the Navy, and Victor Wankowski represents Standard's development and producing departments. This committee so far has functioned strictly as an engineering and operating agency. Each man has numerous assistants, but all matters of policy affecting drilling and production operations at Elk Hills are decided by Commander Stolz and Wankowski. Al Tietze, general superintendent of Standard's producing department, is in charge of producing operations under supervision and in conjunction with Navy personnel.

Present and projected facilities are in striking contrast with usual government operations. Excessive expenditures are avoided. The Navy men are housed under canvas. To provide facilities for operations during the coming winter some temporary construction probably will be necessary. As all the acreage undergoing development is government land, there were no buildings of any kind on the property when the Navy personnel arrived at Elk Hills.

Before Standard assumed charge of development work, the Navy threw three battalions of Seabees into the area and, with customary thoroughness, they went to work. Their first job was constrution of a road along the north flank of the Elk Hills structure, parallel with the axis. Feeder roads then were constructed up into the hills from this primary road and from these feeder roads additional outlets were provided to permit access to various well locations. The Seabees built a total of 33 miles of main and lateral roads in addition to completing grading operations and staking locations for the first 80 wells.

Location of these wells was decided several months in advance while the present operating agreement was being formulated at Washington.

Elk Hills consists of 42,552 acres, of which 38,069, or 89.5 per cent, is government land in Petroleum Reserve No. 1. The field is about 25 miles southwest of Bakersfield, in Kern County, and approximately 9 miles northeast of Taft. Structurally, Elk Hills is an asymetrical anticline complicated by several faults, two of which are of considerable magnitude and cut across the axis of the field. These faults have been found to affect accumulation and drainage in various degrees. Development work, which was retarded for several years by creation of the Naval Petroleum Reserve, has revealed the existence of three closed domes. These topographic features are Tupman dome at the east end, Hay-Carmen dome in the center, and Hillcrest dome at the west end of the structure. Present development is in that 3-mile stretch of undrilled acreage between the Tupman and Hay-Carmen domes. These two domes are productive but no adequate test has been made on the Hillcrest dome, all of which is located on Naval reserve property. Hillcrest dome has perfect closure, however, and presents excellent prospects for production. On the south flank of Elk Hills and lying within Navy Petroleum Reserve No. 1, there are four secondary anticlines, the axes of which roughly parallel the major Elk Hills axis trending almost east-west. Surface topography of Elk Hills closely corresponds with the underground axis of the fold.

The Elk Hills operating personnel is composed of, seated: Victor Wankowski, Standard Oil Co. of California; Comdr. Harry P. Stolz; Al Tietze, Standard Oil Co. of California, and standing: Lt. John Domercq, petroleum engineer; A. W. Noon, chairman board of supervisors, Kern County; Lt. M. S. Eastman, petroleum engineer

Little Activity Until 1919

Due to complications arising over title to lands at Elk Hills and creation of Naval Petroleum Reserve No. 1 in 1910, there was little activity until 1919 when active development of privately owned lands got under way. A wildcat drilled in 1909-10 found some oil, but failed to get commercial production, supposedly owing to mechanical trouble. All public lands at Elk Hills were withdrawn from entry September 27, 1909, and Naval Petroleum Reserve No. 1 was created September 2, 1912. Quickly thereafter Naval Petroleum Reserve No. 2 was created, involving 29,541 acres in Buena Vista Hills. Discoveries had been made at Buena Vista Hills prior to the withdrawing, however, and they were later recognized. Privately owned acreage in both fields subsequently was developed and in some cases leases were executed by the Navy Department, with opera-

tors at Buena Vista Hills and Elk Hills permitting limited development. There are still some federal leases in effect at Elk Hills which the Navy Department probably will take over eventually. Navy petroleum engineers would like to take over all productive acreage in the east end of Elk Hills and suspend production in order to protect the undrilled sections of the field and arrest edgewater encroachment.

Field of First Magnitude

Elk Hills had produced about 165,300,000 bbl. of crude oil to August 1, 1944, indicating it is a field of the first magnitude, in view of the fact it has been scratched only. Large recoveries per acre have been recorded and high porosities and permeabilities are characteristic of the upper zones. In the Tupman, or eastern dome, the oil ranges from 14° to 26°, with most of it over 21°. The highest gravities are usually found in the higher structural locations. The oil is of an asphalt base, not unlike oil of equivalent gravity produced in the Midway-Sunset field nearby, and yields a gasoline of high octane rating. In the Hay-Carmen, or central dome, the oil ranges from 21° to 53° and averages about 35°. Presence of a high-pressure gas cap during the early stages of development accounts for the light-gravity oil in the Hay-Carmen area. Pumping wells in the eastern end of the structure are the rule rather than the exception, but it is possible flowing wells will be completed in existing undrilled areas during the present development program. If sufficient gas is produced, Standard's natural-gasoline plant at South Coles Levee will be used by laying about 2 miles of new line. The development program now under way contemplates movement of all oil by gravity flow direct to Standard's tanks on the north flank of the structure, from which point it will be pumped to the Packard tank farm nearby for storage until sold to the highest bidder under certain conditions.

Elk Hills is a water-drive field, at least in certain areas and therefore ultimate recovery should be large. Edgewater encroachment in the eastern end of the field has become an important factor.

Drilling to date has been confined to the use of rotary equipment. Present practice is to use portable equipment almost exclusively, although some standard rotary rigs are being used because the number of portable rigs available is inadequate. Upon completion of new wells, all surface equipment, including the derrick, is removed and replaced with pumping equipment. Two-thirds of all new production developed by Standard under the operating agreement belongs to the Navy Department.

OPA Seeks to Clarify Oil Prices

WASHINGTON. — In an effort to clarify the maximum price of crude oil in Kansas and Oklahoma by establishing a single ceiling price structure, Office of Price Administration has requested information from crude-oil purchasers in those states, asking also for comments on a scale of maximum prices for grades of oil from 20° to 40° A.P.I. gravity. OPA's letter to purchasers follows:

"Purchasers of crude oil in Kansas and Oklahoma:

"Under Section 11 (b) of RMPR 436, where more than one posted price was in effect in any pool or area on October 1, 1941, the highest posted price is the maximum price for such pool or area. As a purchaser in the Mid-Continent you are familiar with the fact that there were at least three and possibly four main postings by purchasers in Kansas and Oklahoma on October 1, 1941. All provided for $1.25 for crude oil of 40° A.P.I. gravity and above. The three most common postings provided for a 2-cent differential for each degree below 40 and stopped at 29° and below, 25° and below, and 21° and below. The effect of the adoption of the highest posted price in an area as the maximum price, which was included in MPR 436 on August 13, 1943, was to establish for the states of Kansas and Oklahoma the scale starting at 29° as the maximum price for the area. Since purchasers may legally pay below the maximum price, this change seems to have given rise to no questions, since the purchasers posting lower prices merely seem to have adhered to their own postings.

"Under the stripper-well premium plan, however, a problem is created by the different postings. Under the plan the DSC has concluded that it could not justify the payment of the full premium specified in Amendment 2 as revised by Amendment 4 to RMPR 436 in areas where purchasers are not paying the maximum price. Under their regulation where maximum prices are not being paid by purchasers the reimbursible part of the premium will be 35, 25, or 20 cents, as the case may be, less the difference between such purchasers' price and the maximum price. The effect of this requirement is to remove the advantage which the purchaser otherwise would have in paying a price below the ceiling. In order that purchasers will not be unduly penalized in areas where the highest posting as practical matter was not the price at which such lower gravity crude was being sold, it seems desirable to clarify the maximum price of crude oil in Kansas and Oklahoma by establishing one ceiling price structure if this is feasible. In order to determine which scale of posted prices is most realistic for crude oil of gravities below 29° we should like to have you supply the following information for the month of June 1944 at the earliest possible time:

"(1) Your total purchases of crude oil in the states of Kansas and Oklahoma. (2) The barrels purchased between 21° and 29° A.P.I. gravity in these states. (3) The barrels purchased between 21° and 29° A.P.I. gravity in the pools in Kansas and Oklahoma listed in Amendment 4 to RMPR 436. (4) The price at which your purchases were made.

"In addition we should like to

Series of Articles on Utilization of Natural Gas Starts in This Issue

THE Fischer-Tropsch synthesis for conversion of natural gas to liquid hydrocarbons is potentially one of the most important of all the discoveries for the utilization of natural gas resources. Discovered in Germany 20 years ago it was first applied to the gasification and liquefaction of coke from coal. More recent developments have shown how natural gas may be similarly converted to useful liquid hydrocarbons for gasoline, lubricating oil, intermediate oils such as diesel fuel, and other types of petroleum products.

A series of three articles has been written by Arch L. Foster, the Journal's refinery editor, for publication in the Engineering and Operating Section, discussing the literature and technology of this synthesis in which high interest is exhibited now by research organizations. By such a synthesis natural gas may be converted to augment our crude-oil supplies. This series discusses the technical aspects of the synthesis and its development, the nature of the reaction, products made, methods for carrying out the reaction and the catalysts employed for the purpose. Part 1 of the series starts on page 99.

have any comments you might care to have before us either for or against adoption of the following scale as the maximum price in the states of Kansas and Oklahoma: 20° and below, .85; 21°, .87; 22°, .89; 23°, .91; 24°, .93; 25°, .95; 26°, .97; 27°, .99; 28°, 1.01; 29°, 1.03; 30°, 1.05; 31°, 1.07; 32°, 1.09; 33°, 1.11; 34°, 1.13; 35°, 1.15; 36°, 1.17; 37°, 1.19; 38°, 1.21; 39°, 1.23; 40° and above, 1.25.

"This letter is being sent to other purchasers of crude oil in these states. You will appreciate that it is to the advantage of purchasers to have this matter clarified as soon as possible. We are in hopes, therefore, that you can give it your immediate attention."

Transportation Shortages Create "National Crisis"

WASHINGTON. — "The shortage of tank cars, scarcity of tank trucks and almost total lack of heavy-duty tires have combined to create a national crisis in petroleum transportation," according to Col. J. Monroe Johnson, director of Office of Defense Transportation. "Meanwhile," he warned, "military demands for aviation gasoline and other petroleum products are mounting."

Transportation of military supplies must and will come first, Colonel Johnson pointed out. This means that civilians who delay in placing their orders for fuel oil may find that deliveries cannot be made because equipment is tied up in handling military requirements.

Ship Deliveries in July Include 19 Tankers

WASHINGTON.—Among 126 ships delivered in July by commission yards 19 were standard tankers, according to U. S. Maritime Commission. The contractors were: Alabama Dry Dock & Ship Building Co., Mobile, 3; Kaiser Co., Inc., Swan Island, Portland, Ore., 6; Marinship Corp., Sausalito, Calif., 4; Sun Shipbuilding & Dry Dock Co., Chester, Pa., 6. July deliveries aggregated 1,274,433 deadweight tons, bringing the year's production to 990 ships of 9,901,984 deadweight tons. In the corresponding 7 months of 1943 the yards had delivered 1,037 vessels of 10,483,331 deadweight tons. Shortage of manpower in some of the yards and work stoppages contributed to the decline in July production, the commission said.

Mexico to Expropriate All Private Oil Properties

MEXICO CITY. — All privately owned oil-producing properties in Mexico must be expropriated under the law of 1941 nationalizing the petroleum industry, the Supreme Court ruled last week. Most of the private companies operating in this country were dispossessed in 1938, but a few remain.

Powerful Aviation Fuel Announced by PIWC

WASHINGTON. — A surpassingly powerful aviation gasoline will be produced by the American petroleum industry as and when military plans permit, Petroleum Industry War Council announced this week. At present about 80 per cent of the oil industry's high-octane aviation gasoline production capacity is primed to produce the new airplane motor fuel, believed to excel all other gasolines in the world for performance and volatility. Only minor modifications and additions to current refining facilities will be necessary to do this, PIWC declared.

The potential knockout gas for Japan, perfected primarily to accelerate allied air activities according to military strategical demands, is of vastly improved octane rating over the world-famous high-test aviation gasoline which now powers routine "milk run" bombing of Axis European strongholds by United Nations' airmen.

The petroleum industry's latest contribution to mastery of the air is designed to give maximums in sustained speed, short takeoffs, combat radius and load-carrying capabilities.

Should a shift in United States military strategy suddenly call for a change in 100-octane aviation gasoline production from volume to volatility, petroleum industry scientists predict that quantity production of the new fuel would permit bombing of the Japanese mainland on a suburban service schedule.

William R. Boyd, Jr., chairman of PIWC, explained that volume production of this flying fuel must follow quantity production of high-test aviation gasoline currently required for prosecution of the European war.

Seaboard Acquires Leases On 50,000-Acre Block

MIDLAND, Tex. — Leases on a block comprising more than 50,000 acres of land and containing almost 80 sections in South Upton County have been acquired by Seaboard Oil Co. of Delaware. The acreage extends almost the entire distance across the county east and west.

Leases were taken from three ownerships. One-half of the acreage is in the Halff estate lands, and the other half is divided between the Tippett and Amacker lands.

DEATHS

Daniel M. Cannon, 76, retired oil man, died August 11 in Tulsa. He was employed by Philadelphia Gas Co. in Pittsburgh before going to Oklahoma about 35 years ago to serve as production superintendent for the Guffey-Gillespie interests. Later he was production superintendent in Kansas for Continental Oil Co.

Lee Hager, 70, one of the country's best-known geologists, died August 11 in Houston. Following his graduation from Harvard University, he did graduate work in geology and mining engineering. He discovered the sulfur dome at Sulphur, La.; the Hager-Martin oil dome in Louisiana, and the Orange oil field, in Jefferson County, Texas. Dorsey Hager, nationally known geologist, is a brother.

Joseph Grieff, 82, oil producer, died August 5 in Emlenton, Pa.

Samuel A. Grogan, 54, for 31 years a geologist for Gulf Oil Corp., died August 9 in Houston. He was sent to Mexico in 1916 and 9 years later was made Gulf's chief geologist in that country, with headquarters in Tampico. He returned to the United States in 1942.

Maxwell N. Beebe, 63, manager of the Boston office of Tide Water Associated Oil Co., died August 5. Following graduation from the Titusville, Pa., high school in 1900, Beebe got a job with the old Tide Water Oil Co. in Boston and he remained with the organization till his death.

Ralph J. O'Rourke, 57, former president of the Colorado Society of Engineers, and from 1917 to 1921 chief engineer in charge of surveys, laboratories and construction for the Midwest Oil group in the development of the Salt Creek field, died recently in Denver.

J. W. Daniel, 85, retired oil operator, died August 12 in Tulsa.

Fred Sager, 74, pioneer driller, died August 11 in Tulsa. Sager entered the oil business 40 years ago as a drilling contractor, and he operated in Kansas and Illinois before going to Oklahoma. He was one of the first drillers in the Cushing field.

Lester K. Hissom, 55, Clarington, Ohio, district superintendent of East Ohio Gas Co., died recently in a Wheeling, W. Va., hospital from burns suffered in a pipe-line explosion.

Irvin R. Engler, 64, Columbus, Ohio, general foreman for Ohio Fuel Gas Co. and associated with that company 46 years, died August 11.

Root Petroleum Co. Making More Alkylate Than Plant Was Designed For

by Arch L. Foster

Operating well above its rated capacity of 4,500 bbl. of crude charge per day, the 100-octane-number aviation-fuel plant of Root Petroleum Co., El Dorado, Ark., has been operating since early April to add its stream to the total aviation-fuel production of the country. It includes a fluid catalytic cracker, an HF alkylation unit and an aluminum chloride isomerization unit, along with various accessories. One of these makes 4,200 lb. of steam per hour from waste heat.

OPERATING a complete 100-octane-number aviation-fuel refinery, large or small, is not a simple matter, but the personnel at Root Petroleum Co.'s plant at El Dorado, Ark., have fitted their new job into the one they've been handling all these years with a minimum of difficulties and headaches. In the center of the southern Arkansas oil-producing area the plant draws its crude mainly from local production, and has been on stream since about April 1.

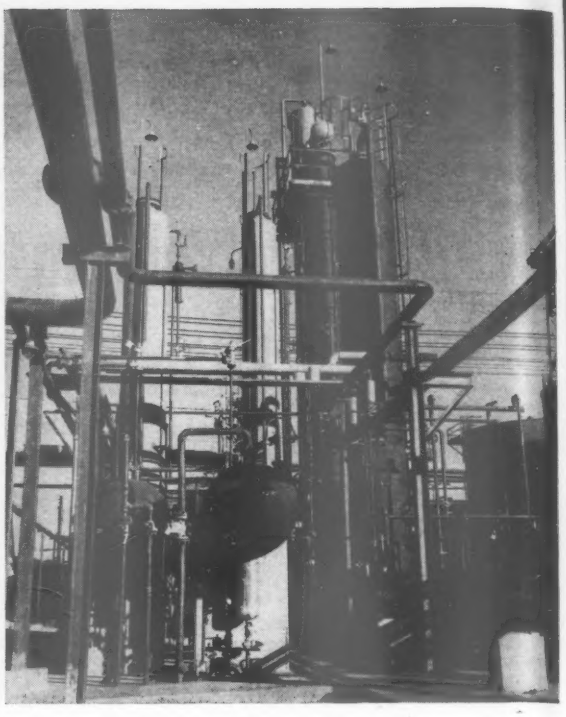
The plant is built immediately adjacent to the old refinery which has been operating for years. The new plant includes the customary number and kind of units for this special purpose: Fluid-catalytic cracking unit; hydrofluoric-acid alkylation unit; aluminum - chloride - HCl isomerization unit, and the necessary auxiliary installations and equipment required to enable these main units to function.

A very brief idea of the major items of material and equipment going into this plant is given by the following summary. The plant requires the use of 32 Ingersoll-Rand pumps of various sizes and capacities, to handle the fluids introduced into and produced in the various units. Four I.-R. compressors, 8XVG, are used for air compression; three 6XVG compressors are needed to handle the compression of the hydrocarbon gases formed and treated in the plant.

The main boiler house includes four 750-hp. Babcock & Wilcox boilers, for a total of 3,000 boiler horsepower. The major steel alloy used in the plant is 12-14 per cent chrome, installed wherever high temperature or abrasive action makes it necessary. The catalytic-cracking unit uses Bigelow-Liptak suspended wall refractory where high temperatures in heating or reaction or regeneration make such necessary. The alkylation unit uses

General view of Root Petroleum Co.'s 100-octane aviation-gasoline plant

Fluid catalytic cracking unit



Girbotol desulfurizing unit

Eagle-Picher type insulation for most purposes.

The catalysts employed include the synthetic "clay" type known as Fluid catalyst, in mesh varying 200 or higher, in the cracking unit, the exact nature of which has not been disclosed. The alkylation unit uses anhydrous hydrofluoric acid. The isomerization plant for converting normal C_4s and C_5s into isomers for use in the alkylation step, uses anhydrous hydrochloric acid and anhydrous aluminum chloride, HCl.

The fluid catalytic unit is typical in practically all important details of last-minute design. It was designed for charging about 4,500 bbl. of gas oil per day, and may be operated either as an initial one-stage catalytic-cracking unit, or as a retreating unit for making retreated aviation base stock. It uses a gas-fired preheater furnace to heat the gas-oil charge before it makes contact with the hot catalyst. All other heating in the unit is done from the heat in the combustion gases from the catalyst regenerator. The unit does not have a catalyst cooler to control the temperatures of regeneration. The regenerator is lined with fire brick, as are the lines carrying catalyst. The reactor is lined with stainless steel. It is understood that earlier units built to operate on this process used high-alloy steels but fire brick is now being installed in later units. This plant was built by Jones & Laughlin Supply Corp.

The charge stock is preheated to 500° F., enters the injector zone where it meets the hot catalyst and is heated to 885°-900° F. before transfer to the reactor. The catalyst ranges in particle size from 50 to 300 mesh. The mixture of catalyst and vapors enters the reaction zone through slotted Meehanite grids. Catalyst and vapor pass upward and reaction takes place. The catalyst rises one-third to two-fifths of the distance up the reactor, then falls away to the sides and drops down to enter a large conduit which conveys it to the regenerator where the carbon deposit is burned by heat and air; as it passes through another grid section it falls away to a catch bin or hopper, is returned to the bin from which it is recycled through the system. The unit holds 120 tons of catalyst, which circulates at the rate of about 4½ tons per minute. It is heated to about 1,050° F. during regeneration. Most of the catalyst falls of its own weight from the path of vapors or gases; practically all that passes to the top of the regenerator is caught by the multiclones or cyclones which send it back to join the main body of catalyst.

The hot combustion gases from the regenerator pass through a steam generator where the heat is used in making much of the steam required by the refinery, this one unit making 4,200 lb. of steam per hour. To catch the last traces of catalyst, these gases then pass through the Cottrell precipitators where a voltage of 40,000 to 70,000 on the electrodes knocks out the suspended particles.

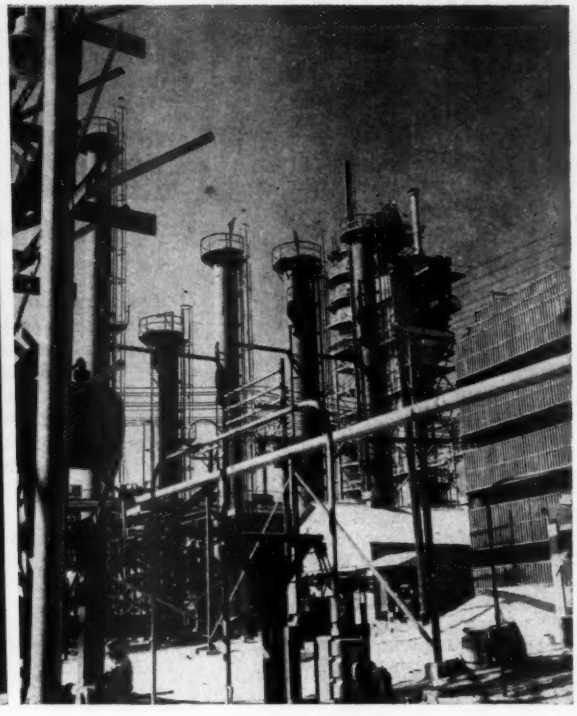
The conversion of gas oil to aviation-base stock is 25 per cent of the gas oil consumed. Some catalyst is carried over with the vapors into the fractionator along with heavy or tarry material formed by too severe cracking, and catalyst and heavy liquid are caught as tower bottoms, and are returned to the reactor to reenter the cycle.

The fractionator divides the cracked product into three parts. All product boiling below 400° F. end point passes overhead; the bottoms are the slurry of catalyst and heavy oil already mentioned; a side cut is taken from the tower, for recycle oil, furnace oil, diesel fuel or any other purpose, and usually shows about 34° A.P.I. gravity, while the bottoms are around 16° A.P.I. before settling the catalyst. The overhead stock is used as base aviation stock after retreating. The mixed Arkansas crude contains about 0.8 per cent sulfur, and the base stock will average about 0.05 per cent sulfur.

Alkylation

Light fractions from the plant's units are sent to a gas concentrator. Butanes and lighter hydrocarbons from the topping, thermal, and catalytic cracking and other units are included in this assembled material. The product from the catalytic and thermal crackers—thermal units in the old section of the refinery—and

Caustic treating system



Gas concentration unit

elsewhere are compressed in three 300-hp. Ingersoll-Rand compressors. Each compressor brings its throughput up to the standard pressure desired, each having three cylinders connected in series. Thus any compressor can be shut down for any purpose without interrupting the others, and operations continue without difficulty. Catalytic gases come in at about 3 lb. gage pressure and go into a second "drum" up to about 20 lb. Thermally cracked gases reach the compressors at about 20-25 lb. and enter the second-stage cylinder, the catalytic gases only using the first stage. In the second stage the combined gases are raised to 60 lb., and in the third stage to around 215 lb. Entering a deethanizer column the ethane and any methane present are taken overhead. A debutanizer column takes off propane and butanes overhead, while a third column splits this mixture to remove the C_5 portion. Another column divides the stripped catalytic distillate into two fractions, taking overhead the C_5s and up to 330° F. end point light fraction and leaving behind the essentially depentanized base stock. This lighter overhead is then split in another column to remove the lighter-than-pentanes portion.

The alkylation unit itself receives C_5s, isobutane, normal butane and butenes and propylene which are mixed with the anhydrous HF catalyst. It is designed for 900 bbl. per day of products, but at present is making 1,300-1,400 bbl. per day. As much propylene is used as the amount of isobutane available will permit. The greater part of the C_5s also is being alkylated.

The amount of olefin in the fresh feed is between 35 and 40 per cent. About 30 per cent of isobutane is present, the remainder being propylene and normal butane. Isobutane is recycled through the unit to maintain an isoparaffin-olefin ratio of about 11 to 1. The reaction is carried out at about 90° F. and the contact time is usually maintained at around 25 minutes. Ultimate yield of alkylate is about 1.6 bbl. of alkylate per barrel of olefin. The alkylate usually shows about 91.5-octane number by the 3-C method.

Isomerization

The aluminum chloride-HCl butane isomerizer was designed for 225 bbl. per day of isobutane. It has proved so efficient, however, that for one period it turned out more than 300 bbl. of isobutane daily. Hydrochloric acid is used as promoter to the catalyst, and is added at the rate of about 8 per cent of the material in the reactor. The reaction temperature is held normally at about 190° F., and contact time is about 5 minutes. Conversion is 40-50 per cent per pass to isobutane. The effluent product is split in the deisobutanizer tower of the alkylation system, the isobutane going directly in the alkylation system while the normal butane is recycled for further isomerization. The HCl is removed, of course, before splitting the effluent and is returned to the system.

In operating the deethanizer, bottoms from the gasoline stripper column enter a midsection of the upper part of the deethanizer. At the top of this same midsection enters a stream of bottoms from the rerunning of raw base stock. Both streams go to a surge drum for feed for the deethanizer. Feed from this surge drum enters the lower stripper section of the deethanizer where light material is taken overhead, and the steam-stripped bottoms, free of ethane, go to the debutanizer.

One of the most important of the considerations in this plant is the data which will be obtained regarding the operation of such units of a size which would be practicable for a large number of small refiners who are not now in position to make aviation fuel or to build catalytic-cracking units.

The operating information so far available appears to show that as far as technology goes, in yields, losses, product quality, and ability to operate the units smoothly and efficiently, the plant is successful. Until peace comes and these units are operated under competitive economic conditions for making mainly motor fuel and peacetime products it will be impossible to determine whether such plants can be made to pay their way.

Drilling Methods in West Edmond Field Designed to Reduce Rig Time on Wells

by Neil Williams

Drilling demands and shortage of rigs in the West Edmond field necessitate maximum utilization of all available equipment. Special emphasis is placed upon the adoption of practices that will shorten the time a rig is tied up upon a well. Efforts to reduce drilling time have been confronted with a number of problems. Some of the phases of time saving in this field are discussed in this article.

REDUCTION of rig time per well is one of the major considerations of drilling contractors in the West Edmond field of central Oklahoma. Average well time in the field is somewhat less now than during earlier development, due to improved technique resulting from increased knowledge of conditions, but with relatively high well costs and the need for getting the maximum average footage possible per rig day, further savings in time are important. The principal problem involved lies in effecting time reductions without sacrifice of necessary precautions to safeguard hole.

Approximately 75 rigs, all rotary, are running in the field, which now spreads over parts of three counties (Oklahoma, Canadian and Logan) with a proved productive area 9 miles long and 3 miles wide, as yet undefined in most directions. Less than 1½ years old, the field has upwards of 110 producing wells, the number being increased from three to four wells weekly. On the basis of 40-acre spacing, it is estimated that at least 500 additional locations remain to be drilled.

Shortage of rigs and drilling equipment has been a factor in preventing more active development of the field. Although the present number of rigs represents the greatest concentration of activity in the country, many more are needed to keep up with location requirements. One major company alone could use at least 25 more rigs if they were available. Consequently, reductions in individual well time are directed toward getting the greatest possible utilization from present rigs in number of wells drilled.

Based on the records of 24 wells (Table 1) representing nearly a fourth so far completed and including both good and bad wells at widely scattered locations, the average over-all well time, exclusive of rigging up, is slightly under 67 days. Of this, approximately 5 days are spent on the surface hole, including running surface casing, averaging approximately 400 ft.; about 54 days in drilling below surface casing to total depth (6,700 ft. to 7,200 ft.), and 8 days in running oil string, waiting on cement, and completing.

Contractors are primarily concerned with the time required in moving and rigging up, getting to total depth and running oil string. Although rigs usually are tied up on locations until completion of wells, the time required for completion generally is assumed by the operating company and is paid for on a day-work basis. With footage contracts for the well, it then is up to the contractors to make the best use possible of the drilling time. However, any extra time required in drilling delays the operating company that much in getting the well on production.

Relatively low contract prices which have existed in the field until comparatively recently have been a particular incentive for contractors to concentrate on reducing well time and costs. Currently, prices are running from $6.75 to $7.50 per foot, with a late contract being made at $8, which is proving more attractive and allowing contractors a greater margin of profit. However, until lately the prices have run from $5.50 to $6.25, which necessitated rather close figuring considering slow drilling. With these prices, contractors usually have been required to furnish not only a complete string of tools but also the derrick, cellar, slush pits, mud up to a cost of $500, water and sometimes fuel, and to stand the expense of running casing. Operating companies provide the casing, cement, and cementing services, both for the surface pipe and oil string.

Efforts to reduce drilling time have been handicapped to some extent by the fact that much of the equipment in the field has been old, some of which under normal circumstances might be considered too light or inadequate. To meet the drilling demand, many rigs have

One of the new, large drilling rigs which have been brought into the West Edmond field. It is powered with three 425-hp. gas engines

TABLE I—AVERAGE DRILLING TIME IN WEST EDMOND FIELD

Well	Total depth (ft.)	Time record (days) Surface hole§	Under-surface hole to TD‡	Completion	Total	Average footage per day under surface	No. bits used*	Type rig
1	7,222	5	61	6	72	111.8	46	Power, 2 12-cyl. engines
2	7,025	7	49	5	61	135.2	45 (2RT)	Power, 2 12-cyl. engines
3	7,027	5	45	11	61	149.5	36	Steam, 4 115-hp. boilers
4	7,133	6	57	9	72	118.1	36	Steam, 3 115-hp. boilers
5	7,178	5	47	7	59	144.2	44 (4RT)	Power, 2 12-cyl. engines
6	6,914	5	72	8	85	92.2	37 (3RT)	Steam, 3 115-hp. boilers
7	7,094	5	74	8	87	87.8	45 (5RT)	Power, 2 diesels
8	7,105	5	47	10	62	142.1	33 (3RT)	Power, 2 8-cyl. engines
9	6,978	5	40	10	55	165.3	31	Steam, 4 115-hp. boilers
10	6,900	5	57	12	74	113.7	34 (3RT)	Steam, 3 125-hp. boilers
11	7,070	5	56	8	69	120.8	38 (5RT)	Steam, 4 115-hp. boilers
12	6,950	5	61	8	80	97.8	37 (3RT)	Steam, 3 115-hp. boilers
13	6,986	5	53	7	65	124.2	36	Steam, 3 115-hp. boilers
14	6,962	5	45	9	59	145.8	31	Power, 2 8-cyl. engines
15	6,859	7	59	†3	69	109.5	36 (2RT)	Steam, 3 115-hp. boilers
16	6,964	5	55	9	69	120.3	41 (1RT)	Steam, 4 125-hp. boilers
17	7,060	3	57	7	67	116.8	39 (1RT)	Power, 2 12-cyl. engines
18	6,980	5	59	11	75	111.5	38	Power, 2 8-cyl. engines
19	7,085	5	48	11	64	139.3	33	Steam, 4 125-hp. boilers
20	7,150	6	66	6	78	102.3	46 (1RT)	Power, 2 12-cyl. engines
21	6,948	4	42	7	53	155.9	36	Power, 2 diesels
22	6,951	4	48	8	60	136.5	31 (4RT)	Power, 2 8-cyl. engines
23	7,050	4	49	6	59	135.7	36	Steam, 3 125-hp. boilers
24	6,839	6	36	7	49	178.9	30	Steam, 4 125-hp. boilers
Total		122	1,283	193	1,604			
Average		5.1	53.5	8	66.9			

*Unless retipped bits are listed, all bits are new. Number includes only bits used below surface casing. †Dry, no oil string. ‡Does not include time running and cementing oil string. §Includes casing and cement time.

been assembled from most any equipment that could be scraped together. Many of them, particularly the steam rigs, date back to the early boom days of the Oklahoma City field.

Maintenance of this equipment has been a major problem and has resulted in much lost time due to shutdowns for repairs and overhauling, thus cutting down the average footage made while drilling. Much time also has been lost in some instances by the necessity for precautions in operation of comparatively light and inadequate equipment.

Use of this older equipment has been inspired by the location of the field close to Oklahoma City, where adequate repair facilities are readily available. Contractors as a rule have preferred to divert their better rigs, requiring less maintenance, to areas where such facilities are not so accessible. Also, in view of the relatively low contracts which existed in the field until lately, there has not been much inducement for contractors to bring in good rigs from other areas, where, in many cases, they could make faster hole at better prices.

Recent advances in contract prices, however, are placing the field in a more favorable competitive position for better rigs, and as a result several new, large assemblies have been moved in and are now operating. With this equipment it is probable that faster drilling-time records than those previously shown will be made.

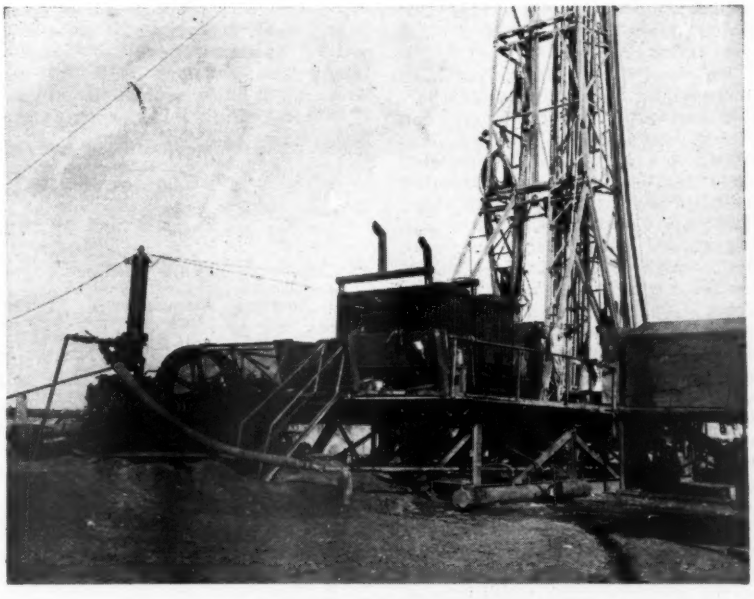
Lack of good water in the field has been a factor in retarding drilling. Until recently the only source of water has been from a small creek flowing through the field. This water has a hardness of around 44 grains, containing an unusually high content of calcium sulfates and other scale-forming solids. Since drilling demands could not be met with power equipment, many steam rigs have had to be pressed into service, and use of the hard water has caused much boiler trouble, necessitating frequent shutdowns for cleaning, refluing and other repairs. This has resulted not only in loss of considerable drilling time but also in excessive maintenance costs. Efforts to treat the water have not proved adequate.

This situation, however, is being solved by piping water from the Old Edmond field, about 5 miles east of the West Edmond field, where there is a good water sand at a depth of approximately 500 ft. The water from that source has a hardness of less than 2 grains, and with its use much of the trouble formerly experienced with boilers is being eliminated. This water carries a high content of sodium bicarbonate, which not only is noninjurious to boilers but also is very desirable for water used in mixing and treating drilling mud.

Water System

Several companies have laid lines to the new water source to supply their operations. The largest system is that put in by Kerlyn Oil Co., one of the largest contractors and operators in the West Edmond field. This system is supplied by three wells, equipped with deep-well Pomona pumps, producing 12,000 to 15,000 bbl. of water daily. The water is accumulated in a large lake in the Old Edmond field, from where it is delivered to the lines by a 7¼-in. by 18-in. reciprocating pump, powered by a 400-hp. V-12-cylinder gas engine. The system at present includes 19 miles of lines, consisting of a 6-in. main line to the West Edmond field with 4-in., 3-in. and 2-in. laterals and feeders in this field serving the various operations of this company as well as several other companies.

Reflecting efforts to reduce rig



Mast-type, collapsible-derrick rig operating in West Edmond field. It is powered with two 225-hp. gas engines

time, several mast-type collapsible-derrick rigs lately have been introduced into the field, designed to speed up rig moves and thus shorten the time between wells. Also, in some instances, spudders have been used to drill surface hole and run and cement surface pipe, doing this before the rotary rig to be used has completed its preceding well. This might save the rotary rig an average of about 5 days (Table 1), but requires maintenance of the unit and calls for additional manpower, and is not entirely satisfactory. The practice is not common. Also, in a few instances, the rotary rig has been moved to the next location after running and cementing oil string, leaving the well to be completed with small cable-tool unit. While this would save an average of about 8 days for the rig (Table 1), it is not regarded as good practice in the field, and no longer is followed. With completion time being paid for by the operating company on a day-work basis, no important saving accrues to the contractor by it.

Surface Hole

Surface hole, averaging approximately 400 ft., usually is drilled with 11-in. rock bit, and then reamed to 13¾-in. size to accommodate 10¾-in. casing. Because of sands and other loose formations in which returns can be lost and which have a tendency to cave, most contractors use from 20 to 30 sacks of bentonite in the mud, building up the viscosity. This requires a little extra time but is considered justified to insure a good hole and prevent the chance of trouble in running and cementing casing which might take considerably more time than that which might be saved in drilling with other practices.

The best time which has been made so far in drilling under surface casing to total depth has been a few hours under 30 days. This record was set by a well completed early last spring. Lately, another well has made this hole in 36 days. However, from 40 to 45 days still is regarded as excellent time, with the average for the field, based on the records of the 24 wells listed in Table 1, being 53½ days.

No intermediate casing string is set, which, with the producing horizon at 6,900 to 7,200 ft., calls for a total of from 6,500 to 6,800 ft. of open hole. This is drilled either with 9-in., 9⅞-in. or in some wells 8¾-in. bits. Down to approximately 5,000 to 5,200 ft. the formations consist of red beds and water sands. In view of the hazards, uncertainties, and problems expected in the remainder of the hole, full advantage is taken of the easier drilling conditions of the upper section to make whatever time is possible. Practice usually is to drill this section with water, circulating through the reserve pit to allow the maximum dropping of cuttings. The water serves the double purpose of facilitating more rapid hole and of obtaining the chlorides picked up in drilling. There are no upper oil or gas horizons to protect, and although there is some loss of circulation the risks incurred are not considered sufficiently great to justify the costs of mixing mud and the additional time which would be involved in drilling with mud.

Water pump station recently placed in operation by Kerlyn Oil Co. in Old Edmond field to supply drilling wells in West Edmond

A shale section underlying the above section and extending to approximately 6,500 ft. is a primary hazard. The shale is soft and disintegrates easily if not properly protected. Extreme caution in drilling and special treatment of drilling mud* are required to hold up the hole and prevent trouble. The danger lies in the formation of enlarged hole, accumulation of cuttings and cavings to ball up behind and stick drill pipe. The precautions to prevent trouble have greatly retarded drilling speed; however, the additional time required is less than what might be consumed by stuck pipe and fishing jobs, or by later trouble which might be experienced in attempting to run and cement casing in bad hole.

Below the shale section to the producing horizon, hard lime formations are encountered in which drilling is slow. Coupled with this is the fact that precautions to hold up the overlying walls must be continued.

Use of a relatively large number of bits, which has increased the number of round trips required, and frequent twistoffs which have occurred in many of the wells, have contributed to the difficulties experienced and increased well time. From 35 to 45 bits have been required under surface casing in most wells so far, although in a few wells the number has been as low as 30.

Bit Time Record

Average bit run time and footage of six representative wells are shown in Table 2. With the number of bits in these wells varying from 31 to 41, the average number of hours runs from 20.4 in the lowest to 25.3 hours in the highest. The average footage per bit ranges from 161.4 to 213.3. With a view toward getting more effective footage per bit, thus decreasing the number of bits required and round trips re-

(Continued on page 82)

*Neil Williams, "Mud Condition in West Edmond Field Involves Special Treating Problems," March 23, 1944, page 135.

TABLE 2—BIT RECORD, WEST EDMOND FIELD

Well (Tab. 1)	Total depth (ft.)	Depth surface casing (ft.)	Footage surface casing to TD (ft.)	No. bits used	Size bit (in.)	Hours bit run	Average hours per bit	Average footage per bit
3	7,027	300	6,727	36	9	735.5	20.4	186.9
6	6,914	347	6,567	37 (3RT)	9	936.0	25.3	177.5
8	7,105	425	6,680	33 (3RT)	9	709.5	21.5	202.4
9	6,978	366	6,612	31	9	699.0	22.5	213.3
10	6,900	421	6,479	34 (3RT)	9⅞	732.0	21.5	190.6
16	6,964	347	6,617	41 (1RT)	9	959.0	23.4	161.4

TABLE 3—DRILLING VS. SHUTDOWN TIME

Well (Tables 1 and 2)	Total hours under surface casing	Hours bit run under surface casing	Hours not drilling under surface casing	Days not drilling under surface casing
3	1,080	735.5	344.5	14.4
6	1,728	936.0	792.0	33.0
8	1,128	709.5	418.5	17.4
9	960	699.0	261.0	10.9
10	1,368	732.0	636.0	26.5
16	1,320	959.0	361.0	15.0

Calculation of Gas Passed in Excess Of Orifice-Meter Range

*by Frank B. Taylor**

While the method described here does not provide as accurate values as those from middle-of-the-chart recordings, it is a quick and ready method of arriving at a value for the volume of gas passed through the meter on those occasions when the differential goes off the chart. Its accuracy is comparable to that of the outer chart ranges.

A METHOD of correction can be applied to orifice meter measurement of natural gas on those occasions when for any one of a variety of reasons the differential goes "off the chart" or beyond the normal measuring range of the orifice and of the chart. The accuracy of the calculation is not as reliable as that to be obtained through the range at which the installation is intended to operate, usually at mid-chart positions, but is comparable to the accuracy of outer chart ranges. In every case, the calculation provides a measurement of the volume passed, and is in no manner an approximation or estimate. The only case in which this calculation does not apply is when the differential will not fall back on the chart even when the meter manifold bypass is opened, and this is because an excessive volume is being passed which is a rare condition.

Not Always Applicable

The method is not applicable to such metering conditions as sometimes occur where gas is measured to a drilling rig where demands vary from minimum satisfactory measurement to excessive ranges which not infrequently carry the differential pen off the chart or to any other irregular demands producing the same conditions. It is applicable to such conditions as occur when an added load is made against a main or lateral line through an orifice installation for a lesser amount of passage; where a well is turned into a line at one differential but feeds at an accelerated rate, such as frequently occurs in pinching a well to a definite volume.

In such cases, the well may be opened to produce at 23 in. of water, but at the pinch gate is held back by ice which formed when the well is opened into the line. Later, after line pressures have stabilized, the freeze will be dissipated and the well will feed at a volume too high to be recorded. This is particularly true of wintertime operation, with exceptionally wet gas, or with wells that occasionally mud off the connections.

Under these and similar conditions the well or measured volume may be beyond chart range for some hours, during which time the unmeasured volume may represent a substantial value to the producer and purchaser. Where sudden excessive demands interrupt normal recording, the fluctuations are momentary and are therefore of less proportionate importance.

For example a well is opened into a lateral system, measurement being through the regular orifice meter installation having a 1-in. orifice in a 4-in. run, and using the 50-in., 500-lb. orifice meter chart illustrated. Upon turning the well in, the flow was adjusted to obtain a normal recording between 20 and 30 in. However, after leaving the well the flow increased suddenly, due to the relieving of the stoppage, and as a result the differential immediately exceeded the outer limit of the meter chart. This condition, noted at 3 p.m., may represent 6/24ths of the chart, or more, depending upon when the well was turned in and when inspection of the meter was made. In the illustration, Fig. 1, 16 hours of measurement were made with the differential riding on the outer limit. The well began feeding at this rate at 3:10 p.m.

At 6:50 a.m. the next day the chart was "pulled," but not until a zero

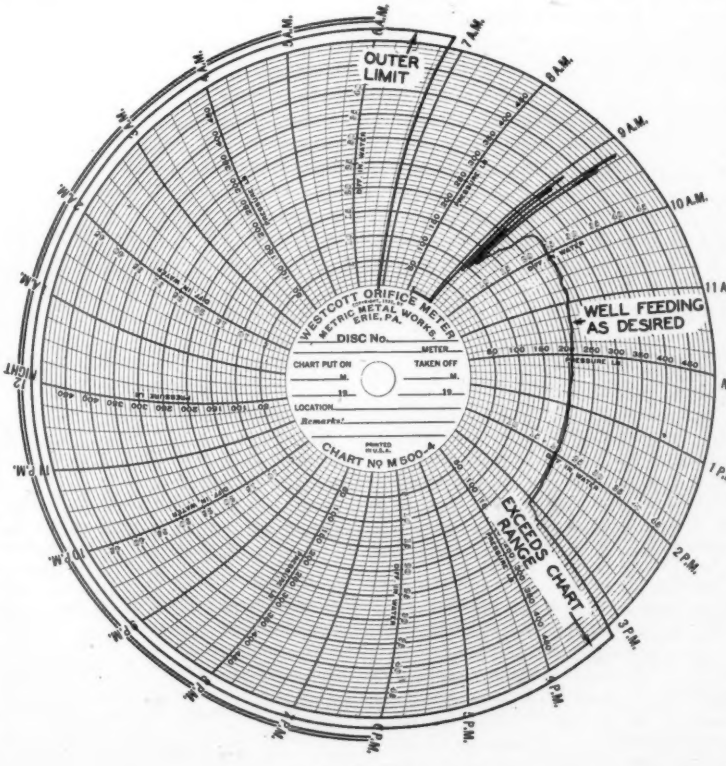


Fig. 1

*Engineering Sales & Commerce Co.

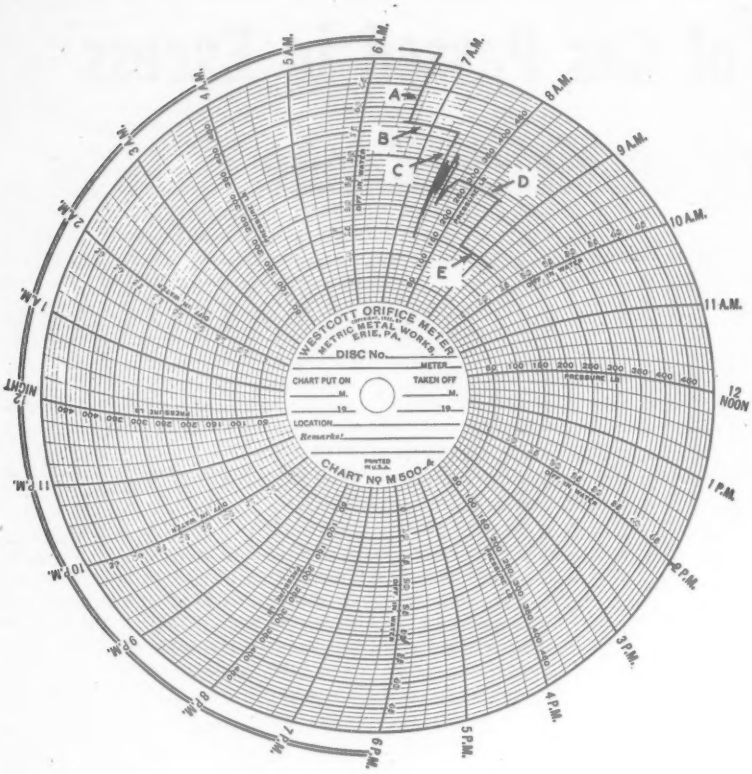


Fig. 2

had been established by turning the manifold out to determine if it was the cause of the trouble. A spare chart, Fig. 2, was then loosely placed so that it could be "thumbed" around, and the meter again put into operation by opening the manifold, the well being left as it had been.

Bypassing of Manifold

With the well producing at the excessive and unknown rate, the meter manifold was bypassed (A), bringing the differential back on the chart at (B) 37 in. The well's production is then reduced (C) sufficiently to allow accurate measurement at a normal range, at (D) 28 in. The meter-manifold bypass is again opened further dropping the recorded differential at 16 in. (E).

This measurement is incorrect in ratio to the error in the (B) measurement, and both measurements are in error proportionate to the actual differential value with the meter bypass closed. Further, one of these actual rates of flow is known to be 28 in., thus leaving only one unknown, that of the unrecorded inches beyond the outer limit of the chart, and this is proportional in the same ratio to the (B) line.

The following equation can then be set up for four factors, where the unknown is in direct ratio to the three knowns:

X equals the unrecorded volume.

$$37 : X :: 16 : 28$$
$$16X = 37 \cdot 28$$
$$16X = 1{,}036$$
$$X = \frac{1{,}036}{16}$$
$$X = 64.75 \text{ in.}$$

A second example may be illustrated when the meter bypass is adjusted so that the chart reading is 40 in., a flow rate established at the well to record at 24 in., and by bypassing a second time, a new value of 12 in. may be obtained. The difference between actual and bypassed recordings being due to variations in meter-manifold construction, fittings used, etc.

The calculation would then be:

$$40 : X :: 12 : 24$$

Solving, it is found that the actual gas flow not measured was at a rate of 80 in. of water.

While values obtained by this method may not be as reliable as those from middle-of-the-chart recordings it is a quick and ready method of arriving at a value for the volume of gas passed through the meter.

Harry T. Straitiff, vice president of Rocky Mountain Drilling Co., Los Angeles, has been commissioned a lieutenant (j.g.) in the Navy and will report for active service August 15.

Drilling Methods in West Edmond Field

(Continued from page 80)

quired, increasing consideration is being given to the problem of determining when and at what points to change bits.

Since footage is made only when the bit is on bottom, special attention is being directed to reduction of time not actually spent in drilling, including time out for rig repairs, trips, fishing and other causes. Table 3 indicates the amount of time spent in not drilling as compared with actual drilling time of the six representative wells listed in Table 2. In several instances the time not drilling, amounts to more than half that actually spent in drilling. The average footage per day, including shutdown time, is shown in Table 1.

Twistoffs have been a major problem in the field. These occur most any place in the hole, but are particularly prevalent when drilling in and below the shale section, and usually are attributed to chunks of formation breaking off and falling in on the bit or pipe. A factor in this may have been the fact that some of the drill pipe which it has been necessary to use in the field has been old or of inferior quality. The number of twistoffs has been materially reduced by improved mud-treating practices. Fortunately, recovery of fish in most instances has not required more than 24 to 48 hours, although in the aggregate the time spent in fishing has been appreciable, and has decreased materially the average footage made per day.

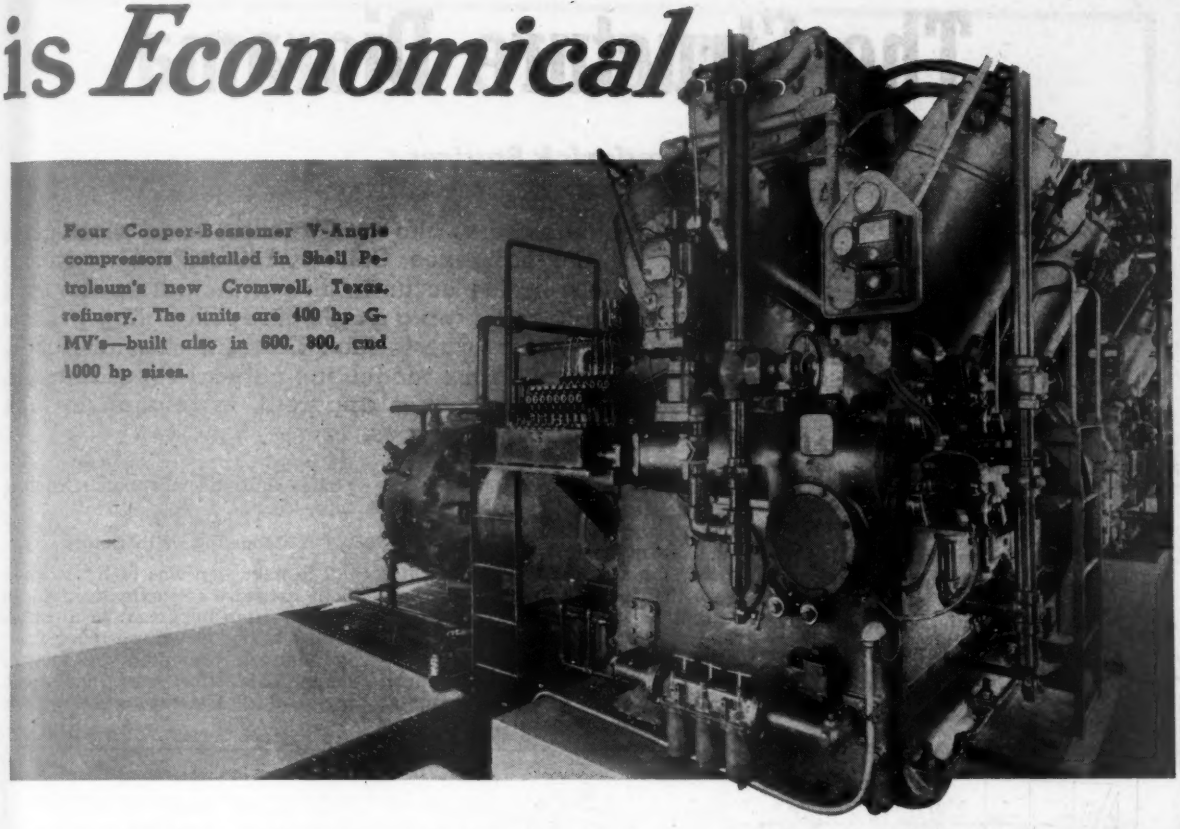
George S. Turner, formerly in the land department of Sinclair Prairie Oil Co., Tulsa, has moved to Midland, Tex., to become an independent operator.

Abraham B. Faoro, who was assistant foreman of the Ventura absorption plant of Shell Oil Co., Inc., has been transferred to the Brea absorption plant in Los Angeles basin and advanced to foreman.

Jack Kiedaisch is in charge of a new office which National Associated Petroleum Co. has opened in Midland, Tex. The company's headquarters were formerly in Great Bend, Kans.

James W. Burrage, assistant superintendent; **Ernest W. Fosshage,** geologist, and **Walter T. Price,** office manager, are new employes announced by The Shamrock Oil & Gas Corp.'s production and transmission department, Amarillo, Tex.

is *Economical*



Four Cooper-Bessemer V-Angle compressors installed in Shell Petroleum's new Cromwell, Texas, refinery. The units are 400 hp G-MV's—built also in 600, 800, and 1000 hp sizes.

sels, gas engines and compressors that went to the oil, gas, and related industries before the war have continued to perform dependably, economically, under the heavier loads and gruelling conditions of wartime, often operated by personnel with little or no experience.

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The Structure Diorama

*by Frederick Squires**

This article describes the construction of a glass-plate model of the Lawrence County, Illinois, oil-producing sands. These sands occur in five principal strata, and when shown together on a single production map present a confusing picture due to their different structural positions and extent. In the model, the vertical separation between any two horizons is apparent, in relation to their respective horizontal planes.

SOME time ago the writer had occasion to investigate the Lawrence County, Illinois, oil-producing sands. These occur in five principal strata, but when the wells producing from all of them were shown together on one production map, the sand or sands from which each well was producing being named only on the well itself, considerable confusion arose as to the outline and extent of each single producing stratum.

Division Into Separate Sands

This confusion was obviated by making a separate map of each sand, and the five maps are here reproduced as Fig. 1. Fig. 2 is a block diagram showing a vertical section through the same sands. Each producing-sand area was then painted in a distinctive color on a separate sheet of glass, and the glass plates were then superimposed in a frame so that the vertical relation of each sand area would be plainly and accurately shown in relation to the others (Fig. 3). These, of course, were shown on separate horizontal planes and did not take structure into account.

Modeling With Colors

The next step was to try to show both structure and extent graphically. It is often important to illustrate deeply buried structures more clearly than is presented by contour maps. This effort was made with pigments. The structure contours on

*Petroleum engineer, Illinois State Geological Survey. Published by permission of the chief, Illinois State Geological Survey.

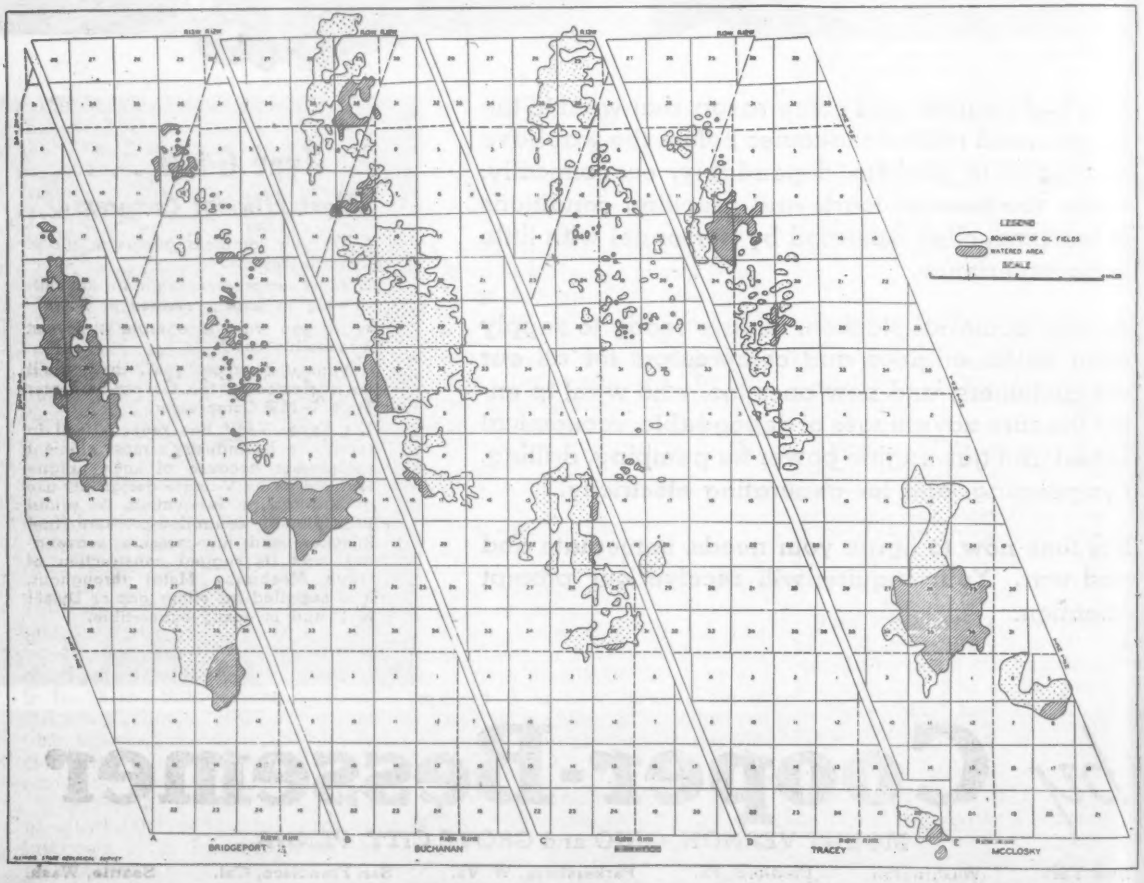


Fig. 1: Map of the oil-producing strata in the Lawrence County pool. These are shown in section in Fig. 2. The drawing was first used in Report of Investigations 89, page 32. It is noteworthy that very few wells find production in more than two sands

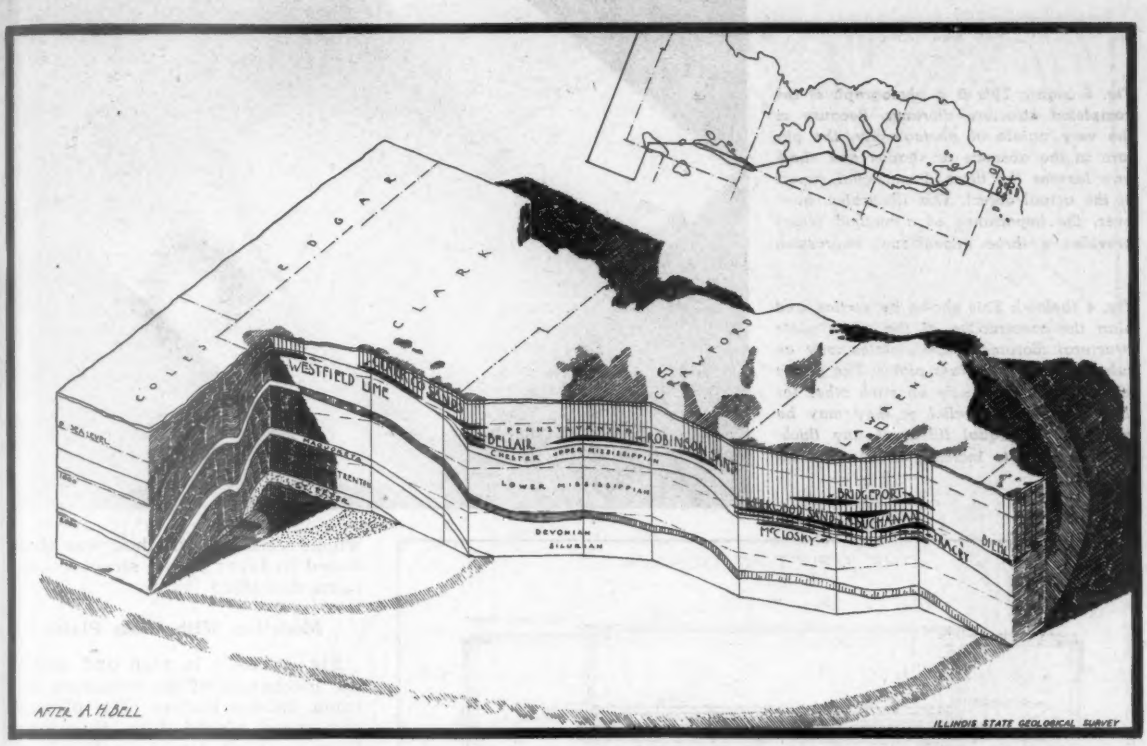


Fig. 2: This is a block drawing which illustrates the vertical relations of the various sands in the old Southeastern fields, and is a diagrammatic section through the sands shown in place in Fig. 1

the McClosky "lime" were drawn and then each level was painted with a different color, the colors, by their differences in tone giving the effect of modeling. Although this presented a fairly good picture of the structure of the single sand, it had to be confined to one stratum at a time because paint is opaque and would obscure pictures of lower strata if other strata were superimposed.

Modeling With Nitrocellulose

A transparent model which would show superimposed strata was next attempted. A producing area with three different oil horizons was chosen and a peg model of the wells was made and built up with nitrocellulose plastic to the upper surface of the lowest stratum. Then this surface was marked with a grid, using a distinctive color, and more plastic was applied over it until the top of the next stratum had been modeled, on which a grid of a different color was made. The third stratum was finished in the same way. This gave a picture of three visible, superimposed, differently colored surfaces, each color grid located like a colored net frozen in a block of ice. But the plastic shrank on hardening and thereby destroyed the accuracy of the modeling, for

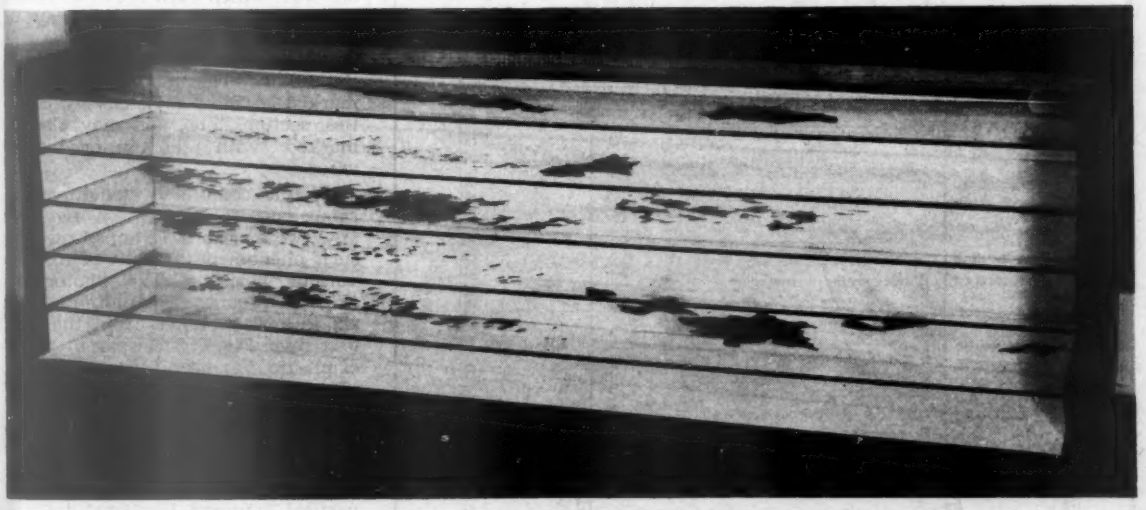


Fig. 3: This is a photograph of a model made of sheets of glass, on each of which is colored the areas covered by the production of a single sand. The plates are so arranged that the areas of sand are superimposed in accurate vertical relation. It is interesting to note the parallel axes of the west and east fields and the connecting link in the Buchanan and Kirkwood sands

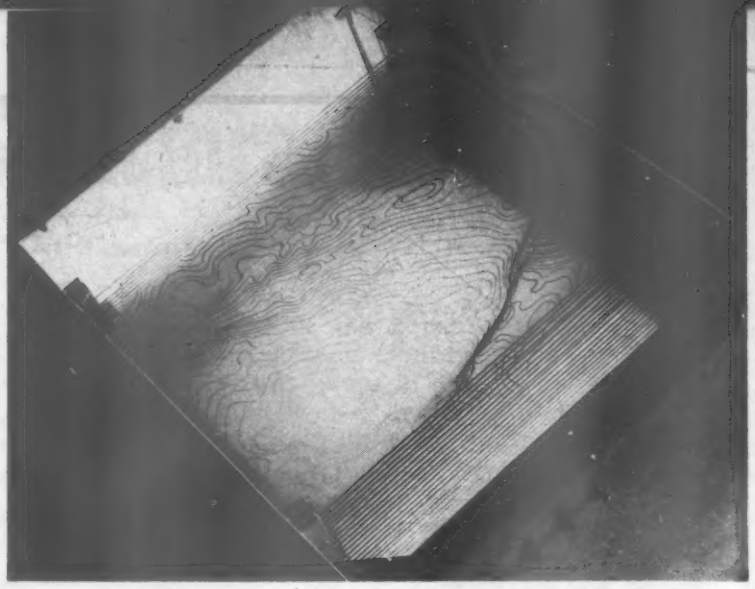
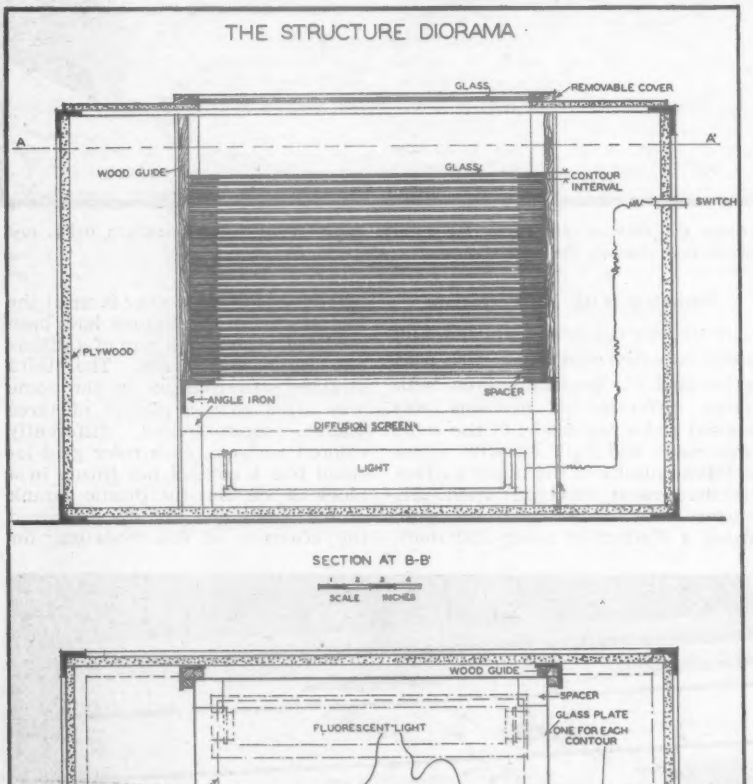


Fig. 5 (right): This is a photograph of the completed structure diorama. Because of the very nature of photography, the picture in the absence of shades and shadows lessens the three dimensional aspect of the actual object. This illustrates, however, the importance of a method which provides a three dimensional impression

Fig. 4 (below): This shows by section and plan the construction of the glass plate structural diorama. Plastic plates may be substituted for the glass plates. The plates may be placed directly on each other for the least possible relief or they may be separated by equal fillers of any thickness in order to increase the contour interval



which reason the method was abandoned in favor of the structure diorama described below.

Modeling With Glass Plates

Fig. 4 shows in plan and section the mechanics of the structure diorama. In the bottom of a plywood box were placed four fluorescent lamps connected to a wall plug for current and operated by switches mounted through the side of the box. Above them is a frame on which were placed sheets of glass, each inscribed in ascending order with a single contour of the structure which is to be shown in three dimensions. The interval between contours may be confined to the thickness of the glass plate or increased up to any greater distance by separating the plates by means of fillers of the desired thickness placed in the corners outside the contoured field. By varying the colors with which each set of contours is drawn, several horizons may be shown in the same diorama, the colors distinguishing each horizon from the others. The top plate is then marked to show divisions by counties, sections, etc., and may also be marked with the oil-productive areas.

In the completed structure diorama, vertical separation between any two horizons is apparent, also such phenomena as shift of axes in various horizons. The photograph (Fig. 5) illustrates a diorama of a single horizon taken from the contour map, Fig. 6. Transparent plates of plastic may be substituted for the glass plates. They are lighter in weight and less fragile.

Other Applications

It is, of course, easy to indicate vertical contours (sections) by distinctively colored dots on the horizontal contours located where the vertical plane cuts them. No doubt

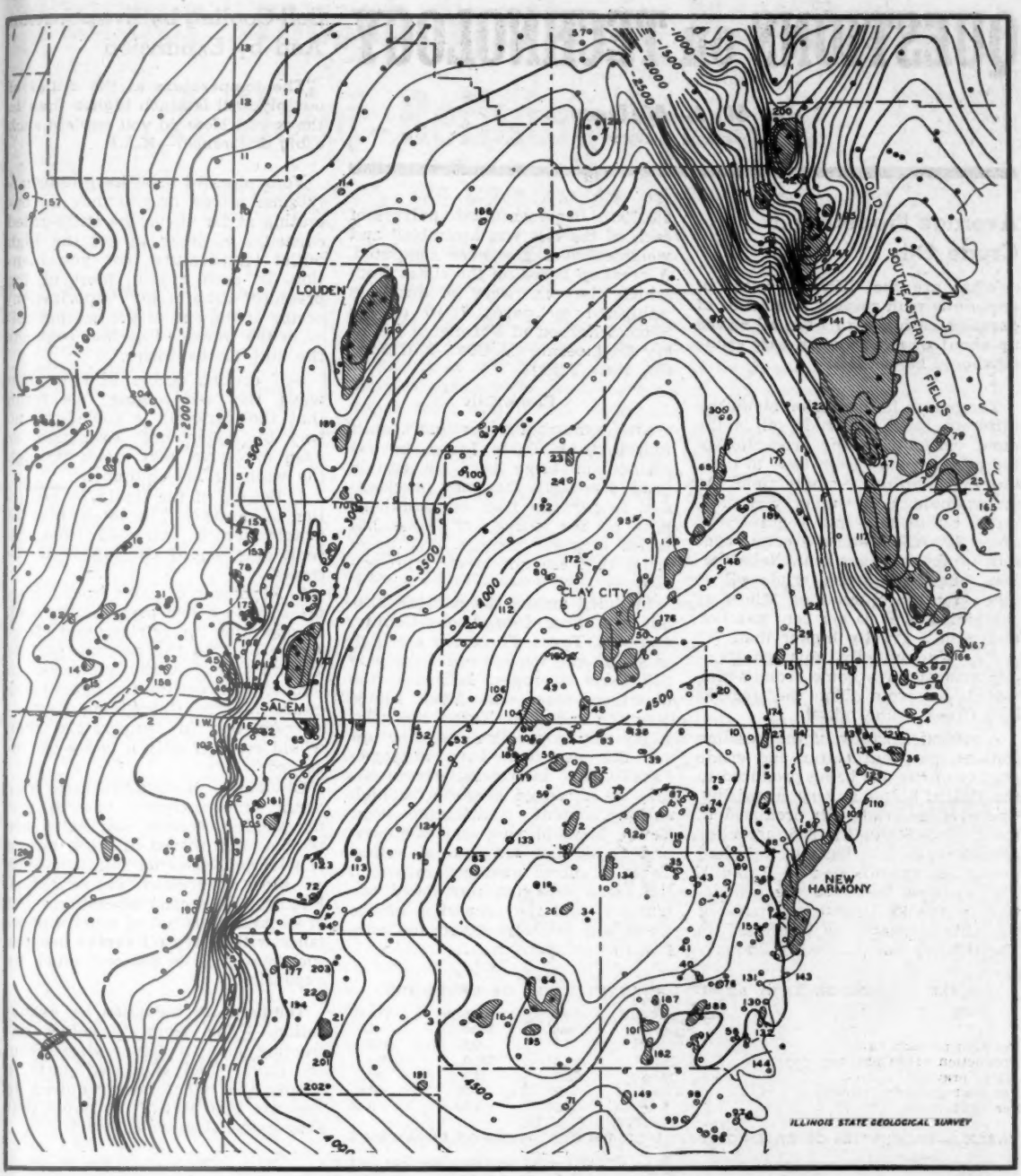


Fig. 6: This is a part of plate 1 published as part of Report of Investigations 92 by A. H. Bell. From it were taken the contours, each of which was drawn on a separate sheet of glass and all collected to form the structure diorama illustrated in Figs. 4 and 5. On Fig. 6 are shown the oil pools and geographical divisions which may also be shown on the structure diorama

an arrangement of mirrors could be devised to give similar results; also vertical planes of shadow cutting across the horizontal contours would produce vertical sections.

Another method of showing sections in vertical planes through the contours drawn on horizontal planes is the use, for each horizontal layer, of two or more abutting rectangles of glass. Sections drawn on the edges of these glass plates at their juncture with each other would result in vertical sections through the horizontal contours.

The thickness of a stratum, for example, a sand, may be pictured at all points by superimposing contours on the top of the sand over contours on the bottom of the sand.

Acknowledgments

The writer wishes to thank C. C. Boley, William H. Easton, A. H. Bell, Dorothy Rose, and A. W. Gotstein for help on this problem.

M. T. Hartwell is now district geologist for Snowden - McSweeney Oil Co., in the new office opened in Midland, Tex.

T. M. Carlyle has been elected president of McDougall-Segur Exploration Co. of Calgary.

QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Average Properties of Crude Oils

What are the different bases of crude oils with respect to amount of gasoline, sulfur, etc.? I am all mixed up about what a paraffin-base crude oil should be.—A.L.B.

The reason for confusion about the different bases of crude oil is the great variation in the properties of the oils, not only from base to base, but even within a single field. As an example, Salt Creek, Wyoming, crude oil usually has a gravity of about 37° A.P.I., and a gasoline content of about 30 per cent. Nevertheless, one Salt Creek crude oil is listed by the Bureau of Mines as containing over 85 per cent gasoline and with a gravity higher than 70° A.P.I. Undoubtedly this gasoline-crude must have come from a different reservoir than the regular Salt Creek crude oil.

A statistical study of the gasoline content, per cent sulfur and crude gravity of the oils being produced in the United States is very surprising. The average crude oils produced in the United States in 1936, arranged according to the base of oil, had properties as indicated in Table 1. This analysis based on the production of the 99 largest oil fields of the United States as published in The Oil and Gas Journal of January 28, 1937. Representative analyses of each of the oils was assembled and weighted averages were computed. A breakup based on the states from which the oils were produced is published on pages 77-80 of the Second Edition of Petroleum Refinery Engineering (McGraw-Hill Book Co., New York).

Freak Oils

The somewhat surprising results indicated by Table 1 can be explained in large part by certain freak crude oils that may be classified as paraffin base or naphthene base by the Bureau of Mines but which in some respects have properties that are not at all representative.

Included among the paraffin-base oils are those from Pecos County, and Van, Texas. These oils are high in sulfur and tend to upset the paraffin-base averages. Likewise, the naphthene-base oils from Pierce Junction and Hull, Texas, are relatively rich in gasoline and they upset the naphthene-base averages. Finally, the intermediate-base oils may be arranged as those of high sulfur content (California, West Texas, New Mexico and Montana) and those that are low in sulfur. Table 2 shows averages in which the freak oils just mentioned are left out—and the properties of the freak oils are also given for purposes of comparison.

TABLE 1—AVERAGE DATA ABOUT DIFFERENT BASES OF CRUDE OIL

	Intermediate base	Paraffin base	Naphthene base	Total oil
Per cent of each base	73.6	16.7	9.7	100
Production (1,000 bbl. per day)	2,210.0	500.0	290.0	3,000
A.P.I. gravity	36.9	38.1	22.0	35.9
Per cent gasoline recovery	34.6	27.7	7.33	30.6
Per cent sulfur	0.49	0.38	1.09	0.55

TABLE 2—PROPERTIES OF BASES OF CRUDE OILS—CORRECTED FOR FREAK OILS

	A.P.I. gravity	Per cent gasoline and naphtha	Per cent sulfur
Paraffin base	39.3	28.4	0.197
Intermediate base—low sulfur	39.2	36.5	0.316
Intermediate base—high sulfur	29.4	24.4	1.53
Naphthene base	21.6	6.28	1.125
Paraffin base—Pecos County, Texas	30.6	22.9	1.53
Van, Texas.	34.3	26.6	0.86
Naphthene base—Pierce Junction, Texas	29.2	40.0	0.18
Hull, Texas	32.5	26.6	0.35
Intermediate base—Ventura Ave., Calif.	30.2	27.6	1.16
Seal Beach, Calif.	24.2	16.0	1.23
Coyote, Calif.	25.9	20.5	1.46
Huntington Beach, Calif.	24.9	18.4	1.42
Torrance, Calif.	21.7	14.6	1.62
Dominquez, Calif.	32.0	22.2	1.76
Playa del Rey, Calif.	24.7	23.0	2.80
Grand Falls, Texas	33.0	34.0	1.50
Chalk-Settles, Texas	26.6	20.8	2.01
Luling, Texas	27.7	13.1	0.92
Hobbs, N. M.	34.2	32.6	1.48
Eunice, N. M.	36.0	32.7	1.37
Sunburst, Mont.	31.9	21.6	1.47

Self-Cooling by Evaporation And by Expansion

The temperature at the outlet of our pipestill is much higher than in the tower. How do you explain such a big difference?—K.E.P.

Your pipestill must have unusually small tubes, or you may be operating at far above the still's rated capacity, in order to get the high outlet temperature that you mention. In such a still, most of the pressure drop (and vaporization) occurs at the end of the heating coil or in the transfer line that connects the still to the tower.

Self cooling occurs in two main ways. By "self cooling" we mean that the material is cooled in no way by water, heat exchange, or even excessive heat losses through the walls of the equipment:

1. Boiling of the liquid by reduction of pressure. The latent heat of evaporation is extracted from the remaining liquid causing it to be cooled.

2. Expansion of gases from a high pressure to a low pressure. In such an operation the refrigeration effect occurs only in the gaseous part of the mixture but the reduction in temperature occurs throughout the entire mixture, thus giving a smaller reduction in temperature than would occur if only a gas were involved.

Obviously, the two processes may occur simultaneously, and in fact the single processes just listed are seldom encountered in the handling of wide boiling-range mixtures such as those processed in refineries. Finally, the second operation, that of expansion, is not of much importance with heavy oil vapors because such materials do not cool much by expansion.

Temperature reduction by evaporation.—This simply involves extracting enough temperature from the liquid (and vaporized part) to supply the latent heat required to vaporize that part of the liquid that evaporates. Algebraically—

$$(L s_e + V s_v)(t_i - t_e) = Vl$$

$$t_e = t_i - \frac{Vl}{L s_e + V s_v}$$

in which:

t_e = final temp.
t_i = original temp.
S_e = avg. sp. ht. of avg. liquid
s_v = avg. sp. ht. of avg. vapor
L = avg. pounds of liquid
V = avg. pounds of vapor
l = avg. latent heat of avg. vapor

Average quantities must be used because vaporization occurs throughout the process so that the pounds

Fischer-Tropsch Synthesis May Prove A Major Refining Process

PART 1—THE REACTION, ITS MECHANISM, AND ITS PRODUCTS

by Arch L. Foster

This is the first of three articles discussing this remarkable synthesis of hydrocarbons, discovered in 1925 and used now in Germany to produce a large part of its war fuel supplies. The process synthesizes hydrocarbons of the petroleum type from either coke and steam (water-gas) or from light hydrocarbons such as natural gases. The type of product made can be varied over wide limits of structure and molecular weight by varying the conditions of operation. This article presents the information in the technical literature which discusses the mechanism of the reaction, giving the two main theories, the Synthol theory of Elvin and Nash, and the carbide theory of Fischer, discoverer of the synthesis; products made by the synthesis are also discussed. Later articles will discuss catalysts used in the synthesis, and the operating conditions and results obtained under varying conditions of synthesis.

THE Fischer-Tropsch synthesis of hydrocarbons from carbon monoxide and hydrogen is one of the most famous in the history of the chemical industry. The possibilities which the discovery of this generic principle of chemical reaction unfolds strains the imagination. The field it offers for the conversion of heavy liquid-to-solid materials, and also the "aufbau" of light gases into hydrocarbons of almost any desired boiling range or molecular weight has opened entirely new prospects for the utilization of natural gases, coal, coke, lignite and vegetable products, in fact almost any organic material which can be "gasified" by incomplete combustion. Admittedly in a difficult position to compete economically with crude oil priced at $1.25 per barrel, the synthesis of motor fuel, gas oil, lubricants, paraffin waxes and other petroleum-like products has been proved technically sound by a long list of competent researchers.

The primary reaction in this synthesis, disregarding for purposes of clarity any side or secondary reactions, is that between carbon monoxide and molecular hydrogen:

$$CO + 3H_2 = CH_4 + H_2O$$
Methane

Franz Fischer and Hans Tropsch, codiscoverers of the reaction, started with water gas, a mixture of carbon monoxide and hydrogen formed by the water-gas reaction between superheated steam and coke at high temperature, according to the reaction:

$$C\ (coke) + H_2O = CO + H_2$$

Similarly, as may be shown later, by heating hydrocarbon gases such as methane with steam:

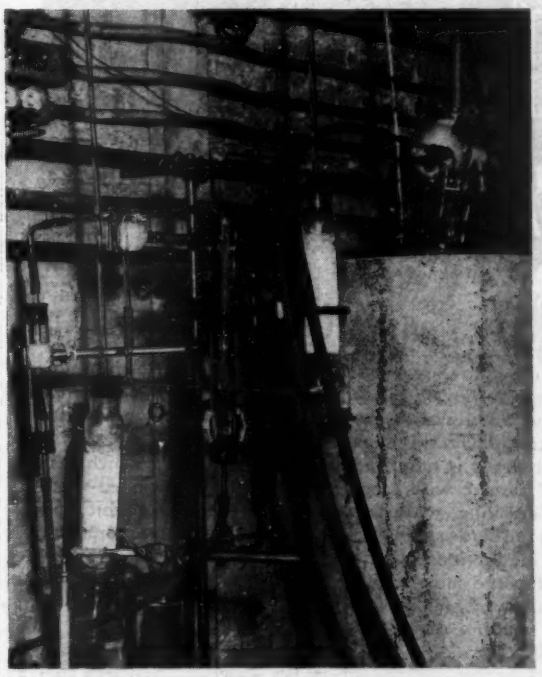
$$CH_4 + H_2O = CO + 3H_2$$

or by incomplete combustion with O_2 of the air,

$$2CH_4 + O_2 = 2CO + 4H_2$$

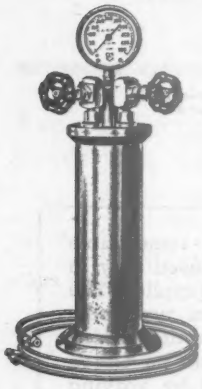
In either case the result is the same as to constituents of the products, carbon monoxide and hydrogen. The equations illustrate the principal reactions by which the primary products or raw materials are formed. All these reactions are in general agreement. From this point, while the products formed are well known, and can be isolated and determined qualitatively and quantitatively, a divergence of opinion and theory exists as to the mechanism of the reaction. Suffice just here to say that CO becomes hydrogenated and polymerized to hydrocarbons of various sorts, ranging from methane to heavy, solid waxes, through the gas-oil and lubricating-oil ranges.

In practice, while details vary widely with different operators, the general plan of operation of a Fischer-Tropsch synthesis unit includes one or both of the following routines. When utilizing coal, coke or other solid nonvolatile raw material, an adaptation of the water-gas manufacturing system is used, by which the solid carbon of the coke, along with steam is converted to



Carbon monoxide and hydrogen are metered and purified before passing into the catalytic reaction chamber, right. A section of the Fischer-Tropsch apparatus at the Institute of Gas Technology

TESTING APPARATUS
for Liquefied Petroleum Gases—C_4 Mixtures



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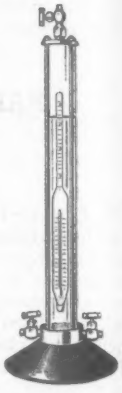
Accurately measures the specific gravity of liquefied petroleum gases such as: butane, butadiene, etc. Can be used on any liquid, which under atmospheric pressure would evaporate into a gaseous form. Sample to be measured is held under vapor pressure conditions corresponding to the temperature of the liquid.



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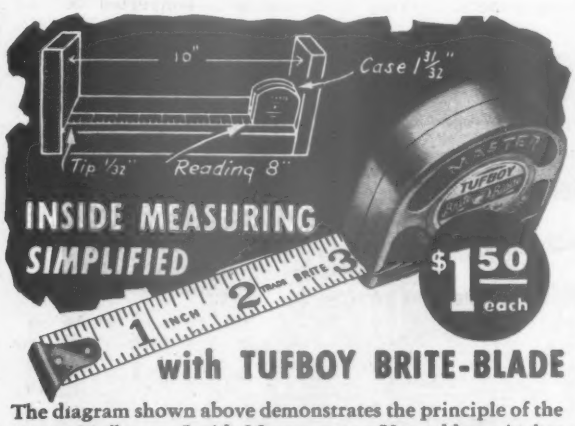

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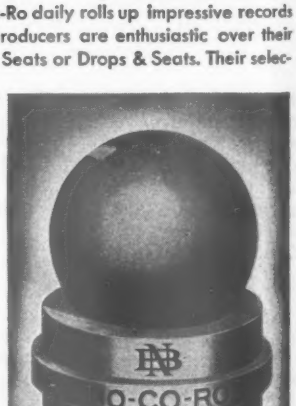

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carbon monoxide and hydrogen. The mixture of gases, generally in the ratio of two parts hydrogen to one part monoxide, is heated to a predetermined temperature and passed over a catalyst, generally composed of a finely divided metal of the Eighth (iron) Group (Periodic System), along with small amounts of alkali oxides or salts, or with other types of promoters. The type of product which predominates in the effluent materials is determined both by the catalyst and by the conditions of the synthesis—ratio of CO to H_2, temperature, pressure and time of exposure to the catalyst, and the nature of the catalyst itself.

In the case of use of natural or other hydrocarbon gas as raw material, incomplete combustion of the gas results in the production of the same materials according to the reaction equation given above. Subsequent steps are identical with those mentioned in the above paragraph when starting with coke.

Mechanism of Fischer-Tropsch Reaction

The mechanism of this reaction of reduction of carbon monoxide to hydrocarbons has been discussed widely in technical circles and in the literature and considerable disagreement exists in the minds of authorities. One investigator (1-1) reporting in 1941 has decided that the catalyst, cobalt in his case, adsorbs carbon monoxide on its surface in some form as represented by the formula $(Co — CO)_x$, or $Co(CO)_x$. While in this form the CO is hydrogenated by the hydrogen present and under the influence of the catalyst, to $Co — (HCOH)_x$; addition of two more hydrogen atoms splits off molecules of H_2O, with formation of $Co — (CH_2)_x$. Addition of other molecules of hydrogen forms CH_4, or $_xCH_4$, freeing the catalyst to again enter the cycle. Under different conditions, the additive compound, $Co(CH_2)_x$, is formed on the surface of the catalyst by adsorption and subsequent hydrogenation. The $—CH_2—CH_2$ - - - - - chain breaks away from its probably secondary type of loose juncture with the catalyst to form C_nH_{2n}, in the form of either olefins or cycloparaffins, isoparaffins by further hydrogenation to add H_2, or other more complicated molecules, as paraffin wax, lubricating oils, etc. This researcher states that the same mechanism occurs with nickel catalysts, also with iron catalysts, except that a side reaction may be the formation of H_2 and CO_2 from CO and H_2O which may be formed earlier in the synthesis.

Another researcher (1-2) postulates that the reaction of hydrocarbon formation is one of hydration of the CO, also followed by dehydration, and probably condensations to form lower oxides. Considering the reaction to be one of hydropolymerization of CO, (1-3) the synthesis is believed by this investigator to include the following two reactions:

$$2CO + 4H_2 = C_2H_4 + 2H_2O$$

$$4CO + 2H_2 = C_2H_4 + 2CO_2$$

He states that high pressures favor the formation of alcohols, aldehydes, etc., that is, retention of the oxygen in the molecule. Water is supposed to split off the molecular complex during the reaction, before condensation. Methane, CH_4, forms mostly at low pressures. As reaction continues and catalyst "centers" become more active, higher complexes are formed with CO_2 or H_2O split off. If a decomposition occurs to produce methane, water and CO_2, it becomes highly exothermic. This author also claims that Fischer believed that hydrocarbon formation was a polymerization of alkyl radicals.

Following further in the line of reasoning introduced by the reference (1-1) above, another Japanese researcher—the Japanese have for obvious reasons investigated the F-T reaction thoroughly — (1-4) claims that, with Co as catalyst, a complex is formed of the nature of

$$\begin{array}{l} Co — Co — Co - - - - -. \\ \quad\quad | \\ \quad\quad C = O \end{array}$$

This is reduced by H_2 to

$$\begin{array}{l} Co — Co — Co - - - - - \\ \quad\quad | \\ \quad\quad HCOH \end{array}$$

then to

$$\begin{array}{l} Co — Co — Co - - - - -. \\ \quad\quad | \\ \quad\quad CH_2 \end{array}$$

These $—CH_2—$ radicals migrate more or less freely over the molecular surface to react and form

$$\begin{array}{l} Co — Co — Co - - - - -, \\ \quad\quad | \\ \quad (CH_2 — CH_2 — CH_2 - - - - -) \end{array}$$

which hydrocarbon chains break off or desorb, to form C_nH_{2n} which may be further polymerized to increase the length of the chain, to establish side chains in the case of isoparaffin formation, or to saturate the molecule to a saturated paraffin. In many cases in the earlier work of research groups, highly saturated, low-octane-number products were formed in the main. Later, means for varying the type of molecule structure formed will be discussed. Methane is not formed in appreciable amounts at 200° C. (392° F.), this author states, but is formed in considerable quantities at 300° C. (572° F.), which he believes occurs by reaction between CO and hydrogen in the gas phase. Action of iron and nickel catalysts are practically identical, this author states. Heating the catalyst with CO at 350° C. (662° F.) causes a heavy loss of activity, probably because hydrogen cannot be adsorbed on the catalyst surface after such a treatment. A general review of the entire development of the process was made by Fischer in Brennstoff-Chemie (1-5) in 1935.

Fischer and Tropsch explained the reaction by assuming the formation of intermediate, unstable carbides with the catalyst metals (1-7). This theory has been corroborated by others (1-6), but Elvin & Nash (1-8) say that this theory does not explain the formation of alcohols and other oxygenated products which may be made in large yields. They explain the reaction by assuming the initial formation of Synthol (synthetic methyl alcohol, CH_3OH), which may be dehydrated to form CH_4 or other higher hydrocarbons. Their researches confirmed the findings of Fischer and Tropsch in other respects.

In their original announcement of the synthesis, (1-9), Fischer and Tropsch reported formation of methane from water gas at 270° C. (518° F.) and higher temperatures, over Eighth Periodic Group metal catalysts, with or without chromium or zinc oxide promoters. At lower temperature ethane and higher hydrocarbons up to solid paraffins were formed and they had then worked out control conditions which produced mostly naphtha boiling range paraffins. They reported their theory that carbides such as Fe_3C_4, or Fe_2C_3, were formed, later being hydrogenated to form $—CH_2—$ radicals which polymerized to higher hydrocarbons. According to their calculations, the theoretical yield from water gas is 190 g. of hydrocarbons; they obtained 100 g. or higher yields in their earlier studies.

Another Japanese report states that (1-11) using a Fe + 25 per cent copper + 2 per cent manganese + 125 per cent kieselguhr + 15 per cent H_3BO_3 + 2.8 per cent K_2CO_3 catalyst, much water was formed at high pressures but not at lower pressures; at 10 kg. per sq. cm. pressure the yield was greater than at higher pressures but catalyst activity declined faster than at one atmosphere. At 50 and 100 kg. per sq. cm. the yield fell sharply with much CH_4 formed. A broad review of the theories of this reaction, along with photochemical data on the carbide theory and the nature of CO bonds is published in the Russian journal, Uspekhi Khimii (1-10).

Types of Products From Fischer-Tropsch Synthesis

As has been stated above, hydrocarbons varying over a wide range

(Continued on page 106)

HEAT TRANSFER FILM COEFFICIENT
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0.001
0.01
0.1
1.0
10.0
AVERAGE GAS TEMPERATURE - DEG. F.
0
100
200
400
600
800
1000
PIPE I.D. - INCHES
0.1
0.5
1.0
5.0
10
MASS VELOCITY - LB./HR-SQ.FT.
100
1000
10000
100 000
1000 000
1X10^7

Fig. 1

PRACTICAL REFINERY ENGINEERING

No. 9—Heat Transfer Film Coefficients— Petroleum Gases And Vapors

by Paul Buthod and B. W. Whiteley

CALCULATION of the thermal film resistance of a gas or vapor flowing inside pipes or tubes is usually based on the Dittus-Boelter equation:

$$h = 0.0225 \frac{k}{d}\left(\frac{dV}{z}\right)^{0.8}\left(\frac{Cz}{k}\right)^{0.4}$$

where the symbols are explained in the accompanying notation. In instances where the gas is being cooled, the exponent of the last term becomes 0.3. The thermal properties of the gas are to be evaluated at the average temperature and pressure. These properties vary considerably and for higher-molecular-weight hydrocarbon vapors or gases, accurate data are either lacking or are not readily available. Such data are ordinarily obtained on the basis of average molecular weight and reduced temperatures and pressures. Thermal values obtained in this manner are only approximations but do serve as a reasonable basis for heat-transfer calculations.

The thermal resistance for methane gas at 14.7 p.s.i. absolute pressure, flowing inside of a pipe and being heated, can be obtained conveniently from an accompanying chart (Fig. 1). To use this chart it is necessary to know the mass velocity, average gas temperature and pipe diameter.

The chart can also be used for other gases at various temperatures and pressures by multiplying the value of "R" obtained from the chart by an appropriate correction factor. These correction factors are plotted in Fig. 2, for some common gases at atmospheric pressures. For hydrocarbon gases at various pressures and temperatures, the correction factors are given in Table 1. It should be noted that for these conditions, the calculated film resistance is only approximate and consequently a safety factor should probably be provided for in actual design.

The use of the chart and correction factors is illustrated by the following examples:

Example 1.—Air at atmospheric pressure is to be heated from 80° F. to 150° F. in a steam heater. The heater is to be made in a shell-and-tube arrangement with steam at 1 atm. flowing on the outside of horizontal tubes, and the air passing through the ⅝-in. 16-gage tubes. The tube bundle is to be made with 20 tubes. If 200 lb./hr. of air are to be heated, find the length of exchanger required.

Solution. — The mass velocity of the gas may be obtained from the rate of flow and the number of tubes.

$$\text{Rate of flow per tube} = \frac{200}{20} = 10$$

lb./hr.

The mass velocity is 7,500 lb./hr.-sq. ft.

The thermal resistance of the gas film may be obtained by using the chart "Heat Transfer Coefficient for Methane," then applying a correction factor for air.

Enter the chart at a mass velocity of 7,500 and move vertically to the average temperature line of 115° F. From this point move horizontally to a pipe size of 0.495, thence vertically and read R = 0.06 on the top scale.

From the correction factor curve, F = 2.03.

$$R_1 = 0.06 \times 2.03 = 0.1218$$

The metal resistance is negligible.

The steam film resistance is found to be approximately 0.0001.

The over-all coefficient

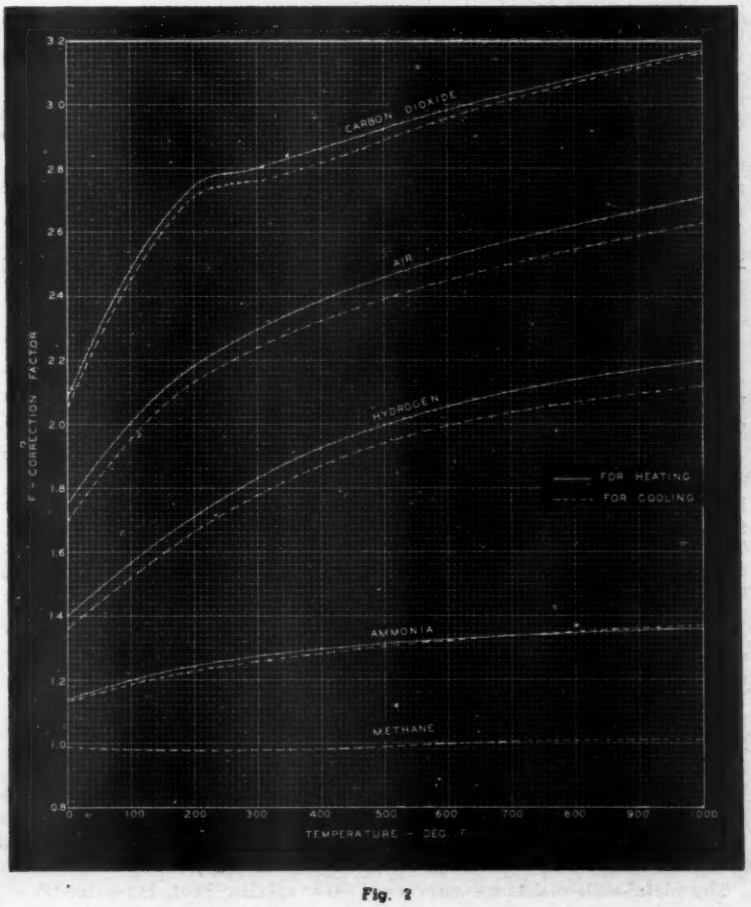

Fig. 2

$$U = \frac{1}{0.1219} = 8.21$$

The log mean temperature difference $t_m = 93°$ F.

The heat to be transferred per hour may be calculated using the specific heat of air as 0.24 B.t.u./hr.-°F.

$$q = 200 \times 0.24 \times 70 = 3{,}410 \text{ B.t.u./hr.}$$

The area based on the inside surface is:

$$A = \frac{q}{U\,\Delta t} = \frac{3{,}410}{93 \times 8.21} = 4.46 \text{ sq. ft.}$$

$$\text{The length} = \frac{4.46}{0.1299 \times 20} = 1.72 \text{ ft.}$$

Neglecting any fouling resistance, the exchanger would need to be about 2 ft. long.

Example 2.—Gas (sp. gr. 0.7) is produced from a natural gas well at the rate of 1,500,000 cu. ft. per day. The well-head pressure is 1,210 p.s.i. and it is necessary to reduce this pressure to 500 p.s.i. The well-head temperature is 80° F. and due to throttling process, it is estimated that the gas temperature will drop 34° F. Hydrates form at 60° F. and it will be necessary to heat the gas on the high-pressure side of the regulator in order to prevent hydrates from plugging the regulator and line. A coil-type heater consisting of 1½-in. hydraulic pipe (i.d. = 1.5-in.) coils immersed in a shell-type water bath is to be used. The water circulates by natural convection and the water side coefficient (corrected to i.d. of 1.5-in. pipe) is estimated to be 200 B.t.u./hr.-sq. ft.-°F. The gas flow is to be divided between two coils in parallel. Calculate the length of heater needed.

Solution.—In order to prevent hydrate formation, the gas must be heated to 94° F. on the high-pressure side. Each gas coil will handle 750,000 cu. ft. of gas per day. The corresponding mass velocity is 144,000 lb./hr.-sq. ft. From the accompanying chart, the uncorrected thermal film resistance for this mass velocity and an average gas temperature of 87° F. is found to be R = 0.0075. From the correction-factor table, the correction factor for 1,200 p.s.i., 87° F. and specific gravity of 0.7 is found to be approximately 1.25. The resistance on the gas side then is:

$$R_i = 0.0076 \times 1.25 = 0.0095$$

The metal-wall resistance corrected to the inside pipe diameter is:

$$R_w = 0.0005 \times \frac{3.0}{3.4} = 0.00044$$

The resistance on the water side is:

$$R_o = \frac{1}{200} = 0.005$$

The total resistance to the flow of heat is:

$$R_T = 0.0095 + 0.00044 + 0.005 = 0.0149$$

The over-all coefficient is:

$$U = 1/R_T = 1/0.0149 = 67 \text{ B.t.u./hr.-sq. ft.-°F.}$$

The temperature of the water surrounding the tubes is necessarily less than the boiling point and it is estimated that a water temperature of 180° F. can be maintained. The true mean temperature difference then is:

$$\Delta t = 93° \text{ F.}$$

The amount of heat to be transferred is computed from a gas heat balance. Using a specific heat of 0.675:

$$q = 3{,}340 \times 0.675 \times (94\text{-}80) = 31{,}600 \text{ B.t.u./hr.}$$

The required surface area of the exchanger based on the inside pipe diameter is:

$$A = 31{,}600/67 \times 93 = 5.07 \text{ sq. ft.}$$

One square foot of pipe is equivalent to 2.54 lineal feet and the total length of the two coils is:

$$L = 2.54 \times 5.07 = 12.9 \text{ ft.}$$

Notation:

- q = amount of heat transferred, B.t.u./hr.
- U = over-all coefficient of heat transfer, B.t.u./hr.-sq. ft.-°F.
- Δt = true mean temperature difference, °F.
- F = correction factor to be applied to thermal resistance as obtained from chart
- h = film coefficient, B.t.u./hr.-sq. ft.-°F.
- R_i, R_o, R_w = thermal resistance = 1/h
- k = thermal conductivity, B.t.u./hr.-ft.-°F.
- d = pipe diameter, ft.
- D = pipe diameter, in.
- V = mass velocity, lb./hr.-sq. ft.-°F.
- z = viscosity, lb./ft.-hr.
- C = specific heat, B.t.u./lb.-°F.

TABLE 1—CORRECTION FACTOR FOR THERMAL FILM RESISTANCES OF PETROLEUM VAPORS

(Multiply thermal resistance of methane at 14.7 p.s.i. abs. by correction factor to obtain approximate thermal film resistance of vapors flowing inside pipes)

Sp gr. of vapor (air = 1)	Pressure (p.s.i. abs.)	Temp. (°F.)	Sp. heat C_p	Correction factor—F
.55	500	0	.589	1.09
.55	500	100	.605	1.09
.55	500	200	.621	1.09
.55	500	300	.668	1.05
.55	500	400	.711	1.00
.55	500	500	.756	0.96
.55	500	600	.804	0.92
.55	500	800	.905	0.85
.55	500	1,000	1.00	0.81
.55	1,000	0	.727	1.27
.55	1,000	100	.664	1.25
.55	1,000	200	.664	1.24
.55	1,000	300	.692	1.22
.55	1,000	400	.728	1.15
.55	1,000	500	.767	1.11
.55	1,000	600	.813	1.07
.55	1,000	800	.913	0.91
.55	1,000	1,000	1.008	0.89
.55	2,000	0	.995	1.33
.55	2,000	100	.758	1.21
.55	2,000	200	.726	1.14
.55	2,000	300	.726	1.09
.55	2,000	400	.754	1.03
.55	2,000	500	.789	0.98
.55	2,000	600	.828	0.94
.55	2,000	800	.922	0.86
.55	2,000	1,000	1.016	0.81
1.0	14.7	0	.38	1.49
1.0	14.7	100	.43	1.42
1.0	14.7	200	.48	1.25
1.0	14.7	300	.53	1.23
1.0	14.7	400	.58	1.15
1.0	14.7	500	.63	1.07
1.0	14.7	600	.68	1.07
1.0	14.7	800	.78	1.0
1.0	14.7	1,000	.88	0.94
1.0	500	0	....	...
1.0	500	100	.62	1.34
1.0	500	200	.55	1.32
1.0	500	300	.57	1.31
1.0	500	400	.61	1.21
1.0	500	500	.65	1.13
1.0	500	600	.70	1.11
1.0	500	800	.79	1.03
1.0	500	1,000	.89	0.95
1.5	14.7	0	.365	1.29
1.5	14.7	100	.415	1.24
1.5	14.7	200	.465	1.21
1.5	14.7	300	.515	1.18
1.5	14.7	400	.565	1.12
1.5	14.7	500	.620	1.07
1.5	14.7	600	.670	1.04
1.5	14.7	800	.775	0.97
1.5	14.7	1,000	.875	0.92
1.5	500	0	....	...
1.5	500	100	....	...
1.5	500	200	....	...
1.5	500	300	.653	1.29
1.5	500	400	.616	1.29
1.5	500	500	.650	1.23
1.5	500	600	.691	1.18
1.5	500	800	.789	1.09
1.5	500	1,000	.884	1.01
2.0	14.7	0	....	...
2.0	14.7	100	.40	1.26
2.0	14.7	200	.45	1.23
2.0	14.7	300	.51	1.18
2.0	14.7	400	.56	1.13
2.0	14.7	500	.61	1.19
2.0	14.7	600	.66	1.23
2.0	14.7	800	.76	1.30
2.0	14.7	1,000	.86	1.33
2.0	500	0	....	...
2.0	500	100	....	...
2.0	500	200	....	...
2.0	500	300	....	...
2.0	500	400	.684	1.35
2.0	500	500	.660	1.32
2.0	500	600	.686	1.27
2.0	500	800	.777	1.14
2.0	500	1,000	.872	1.03

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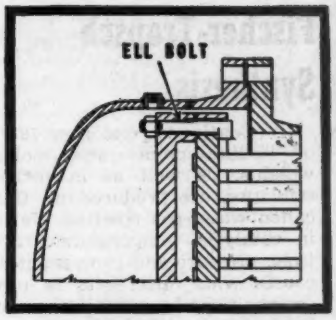

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Fischer-Tropsch Synthesis

(Continued from page 101)

of boiling points and molecular weights, as well as in molecular structure, are produced by this so-called water-gas reaction. Variation in catalysts, temperatures, reaction time, pressure and component ratios causes wide differences in product composition. In general the normal products are straight-chain paraffins, ranging from methane upward in molecular weight. More recent advances in the technology show the way to produce more olefins and isoparaffins, especially those of low molecular weight. Methods for producing these different hydrocarbons, and for varying the molecular structure will be discussed in more detail in Part 2 of this article.

Originally the effluent products from the water-gas reaction were divided into two fractions called Kogasin I and Kogasin II. The first is naphtha-like in boiling range, the second is referred to as the gas-oil fraction. The first fraction may be reformed if desirable, to produce high-octane-number material. The second or heavy fraction may be cracked by either thermal or catalytic processes to form our typical cracked gasoline as made from petroleum.

Separation of the various types of hydrocarbons from the fraction of Kogasin I boiling below 100° C. (212° F.) shows (4-1) that olefins can be separated from the paraffins by the mercuric acetate method. Each subfraction was subdivided into individual hydrocarbons using the semimicrofractionating of Lochte. Separating the paraffin by 58 fractionations identified normal C_5, C_6 and C_7, isobutane, 2 i-pentanes, 2 i-hexanes and trimethylethane (i-heptane). To separate the olefins required 134 fractionations, identifying pentenes, hexenes, heptenes; methylpentenes and methylheptenes were also found. Most of these were unbranched alpha and beta olefins; isoolefins were negligible in amounts if present at all. In another case (4-2) a heptane fraction of Kogasin I showed, when treated with 20 mol per cent of antimony pentachloride at 0° C. (32° F.), that about one-third of the product was tertiary alkylmethanes, while two-thirds were either normal paraffins or quaternary isoparaffins of the type formula $C-\overset{C}{\underset{C}{C}}-C$, (tetramethylmethane, or isopentane).

Formaldehyde and methyl alcohol can be made from CO and H_2 by proper manipulation of the operating conditions and catalysts [4-(3)-2]. Phosgene can be made from CO and Cl_2 under conditions outlined very imperfectly by the patentee, and the reaction may be carried out in a liquid which may be the product itself, "after preliminary activation of the charge by thermal, electrical or other treatment." Solid paraffins are made by holding the charge at elevated pressures in the presence of the catalyst for "predetermined lengths of time" which are more extended than the reaction time for lighter products [4-(3)-1].

Mono-olefins made from CO and H_2 and found in Kogasin I are polymerized with $AlCl_3$ as catalyst, carrying out the reaction in n-heptane as inert solvent. The lubricating fractions formed showed excellent properties, varying with the olefin reacted and the position of the double bond [4-(2)-1]. It was found that tertiary olefins make the poorest lubricating hydrocarbons. Unsaturated hydrocarbons from Kogasin II, the so-called gas-oil fraction from the Fischer-Tropsch reaction, were chlorinated and condensed with aromatics by the Friedel Crafts reaction using $AlCl_3$ as catalyst [4-(2)-2]. The best products were obtained from xylene and tri- or tetrachlor derivatives of the olefins. Catalytic hydrogenation of the heavy products gave viscous, water-white oils of good lubricating properties, Fischer and Koch state.

Olefins and Heavy Hydrocarbons

Again, olefins from Kogasin I were polymerized with anhydrous $AlCl_3$ catalyst and without the introduction of aromatics. The lubricating oils so prepared "compared with the best petroleum products in oxidation resistance, carbon residue, and in their properties at low temperatures such as fluidity" [4-(2)-3]. Another method proposed for making lubricants is by hydrogenating CO catalytically to hydrocarbons, cracking these hydrocarbons to olefins thermally or otherwise, and polymerizing the olefins so formed to lubricating oils, reacting at 140°-240° C. (284°-464° F.), without introducing halogenated hydrocarbons [4-(2)-4].

Practically no aromatic hydrocarbons were found in the products of the earlier syntheses. The residue from the raw products after distilling off Kogasins I and II, the gasoline and the gas-oil fractions, is reported by Fischer and collaborators to be almost entirely paraffin waxes [4-(2)-5]. These paraffins may be chlorinated, [4-(2)-6], to any desired degree and then olefinized by splitting off HCl with concentrated sulfuric acid, polymerizing the olefins formed by the same catalyst. Or, the paraffins may be chlorinated to 12-15 per cent Cl and polymerized, or may be used via the Friedel & Crafts reaction with $AlCl_3$ to form lubricating oils [4-(2)-7].

The Fischer-Tropsch reaction may be used to produce Kogasin I fractions containing up to 55 per cent mono-olefins, using a cobalt catalyst. Lubricants may be made from this product by the Sullivan reaction with $AlCl_3$ catalyst after chlorinating the waxes. Low-boiling olefins present may also be treated with 5 per cent $AlCl_3$ and polymerized to viscous hydrocarbons. In another version, Kogasin II was treated with chlorine to the extent of 1 to 2 atoms of Cl per molecule and the chloro compounds treated with Al metal until the chlorine is removed which yields white, viscous oils. By combining chlorinated Kogasin II with aromatic hydrocarbons via Friedel & Crafts ($AlCl_3$ catalyst), lubricants of higher specific gravity are formed than are produced by polymerizing Kogasin II alone.

The ratio of CO to H_2 in the reaction mixture in the Fischer-Tropsch reaction determines the percentage of olefins formed. The more hydrogen present the lower the olefin percentage formed, and vice versa, the less hydrogen, the more olefins. The heavier the Kogasin the lower the olefin content, Fischer reports. Lubricants made from a Kogasin I fraction boiling between 302°-392° F. make the most practical products, Fischer says, with moderately high viscosity indices and low pour points. Practical experience indicates that in normal operation of the process for this synthesis, about eight parts of light hydrocarbons are made for each part of lubricating or heavy viscous hydrocarbons.

Nickel catalysts are said to form more highly saturated hydrocarbons than do iron or cobalt catalysts. Consequently the use of the latter types of catalysts is indicated when other than highly paraffinic products are desired. Because of the close interconnection between types of products and catalysts, and operating conditions further discussion of this phase will be given in Part 2 of this article.

Using a catalyst which has been already used one or more times, enough to form the $AlCl_3$-hydrocarbon heavy, dark oily complex, better results are obtained in the Friedel & Crafts reaction than when using fresh catalyst. This indicates that the complex is more active, i.e., a better catalyst, than is the uncombined chloride, a presumption not in disagreement with the fact that in other reactions this chloride requires hydrogen chloride as promoter to obtain the desired results. This is true especially in $AlCl_3$ isomerization of normal to isoparaffins. Reacting chloroparaffins with aromatics forms first a light product containing one chloroparaffin molecule and one aromatic molecule; also a heavy product containing two aromatic

molecules per molecule of chloroparaffin; this latter product is of approximately 450 molecular weight. Further investigation indicates that to form high-viscosity-index lubricating materials, chlorination of the paraffin or olefin should not go beyond the trichloro derivative of Kogasin hydrocarbons.

In the preparation of heavy oils, the polymerization product, unsaturated, has been hydrogenated with a Ni catalyst, and found in the specific instance referred to, to add about 5.5 mols of hydrogen per mole of hydrocarbon, indicating the presence of two aromatic—benzene—rings per hydrocarbon molecule. By this hydrogenation the gravity of the oil is lowered; in one instance pour point was depressed from minus 20° C. to minus 27° C. (—4° F. to —16.6° F.). Conradson carbon residue was reduced from 0.17 per cent to 0.03 per cent. Fischer and other experimenters report that these synthetic white oils do not lose film strength or lubricating value as do commercial oils from petroleum sources. In the synthesis of these oils 5 per cent of catalyst, $AlCl_3$, calculated on the Cl-Kogasin charge, is sufficient to carry out the reaction satisfactorily.

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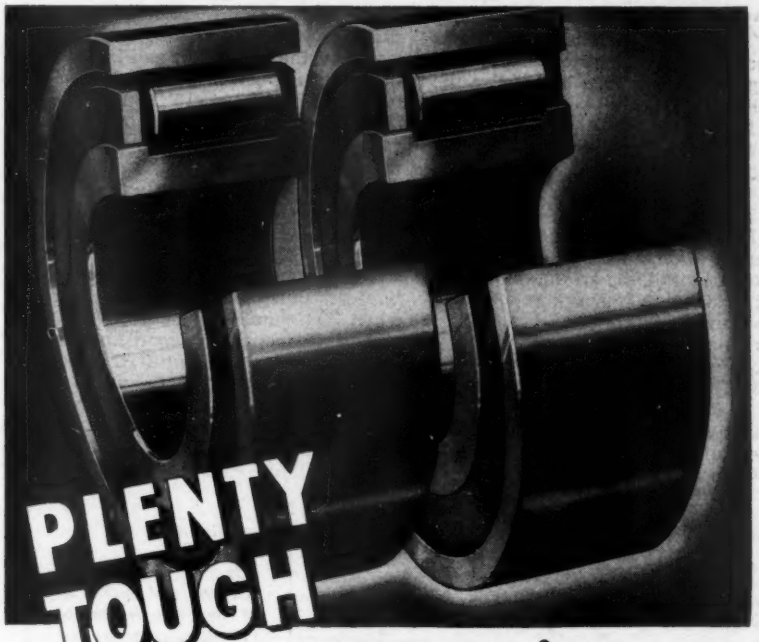
Oscar Grubbs has been made superintendent of measurement for Houston Natural Gas Co., a newly created position. Grubbs, who graduated in petroleum production engineering from University of Texas, joined Houston Natural in January 1941.

Roy F. Kline, assistant general superintendent of the southern division pipe-line department of General Petroleum Corp.; **E. J. Carnahan,** production superintendent, and **Jack McGee,** superintendent of equipment for the production department; and **Ben Parsons,** vice president and director in charge of production, recently completed 30 years with General Petroleum and were awarded service pins.



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The Refiner's Notebook

WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Eliminating Vapor Space In Storage Tanks

CONSTRUCTIONS that nearly eliminate the customary vapor space of a tank are of the following varieties or are known by the following names:

1. Water-displacement tanks.
2. Floating roof.
3. Piston-type roof.
4. Wiggins pontoon roof.
5. Graver expansion roof.

In order to completely suppress vaporization, such equipments would have to be strong enough to withstand the maximum vapor pressure of the liquid when it is at its highest climatic temperature. However, the evolution of the small amount of gas (or air) or very low-boiling material contained in the liquid greatly reduces the vapor pressure and hence most of these tanks contain a small amount of vapor; in most instances the floating roof rests upon a cushion of vapor. Nevertheless, the vapor cannot escape from the tank; it is merely reabsorbed into the liquid when the tank cools at night. Vapor-pressure data cannot be given here but No. 7 of the Refiner's Notebook will give information on common materials. These tanks are used mainly for gasoline or crude oil. An extremely heavy roof would be required for more volatile materials such as natural gasoline and hence pressure tanks are used for such materials.

Displacement of a liquid by means of water is widely used for naval fuel-oil tanks. Obviously, the specific gravity of the oil must be less than that of water, and in fact the British Royal Navy specifies a fuel-oil gravity of 12° A.P.I. or higher. To a limited extent, underground storage tanks are of the water-displacement variety.

Elimination of vapor space is particularly valuable for tanks that are emptied and filled at frequent intervals. The vapor contained in a regular tank is almost completely lost during filling and then when the tank is emptied air rushes in causing vapor to be evolved from the oil until the air becomes saturated with vapor. In addition, the danger of fire always exists when air-vapor mixture is discharged from the tank. No other type of tank construction completely eliminates filling losses although an extremely large balloon or gas-holder system (see No. 6 next week) can stop most of the filling loss particularly if care is used in seeing that several tanks (on the balloon system) are not filled at the same time. Floating roofs and similar constructions are justified for gasoline tanks if they are emptied as often as every 2 months. Crude oil is less volatile than gasoline and hence floating roofs are justified if they are emptied more frequently than once a month. In blending natural gasoline or very volatile materials into crude oil or gasoline, the floating-roof construction greatly suppresses vapor losses.

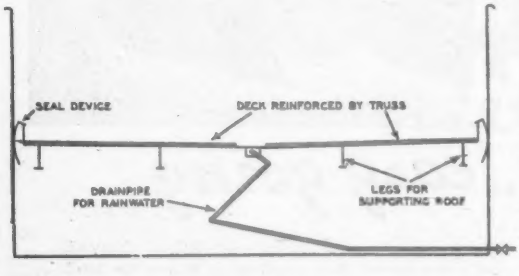
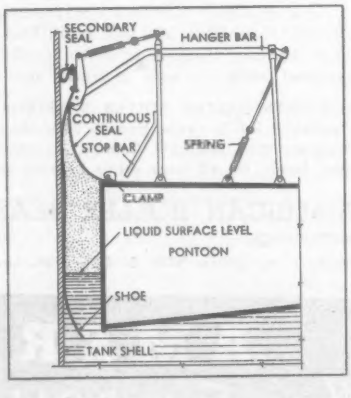


Fig. 1 (left): Simple floating roof tank. Fig. 2 (below): Section of Wiggins pontoon roof seal used with riveted and lap-welded tank shells



Floater Roofs

The deck of the Wiggins pontoon-roof tank consists of a round air-tight "doughnut" ring or floater. This ring supports the center part of the roof as well as the truss construction of the roof, the steel work required for the seals at the

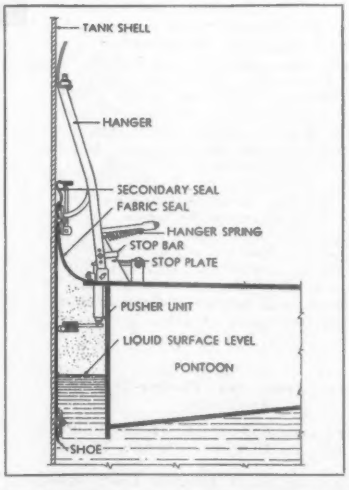


Fig. 3: Section of Wiggins pontoon roof seal showing details of shoes used with butt-welded tank shells. Figs. 2 and 3, courtesy Chicago Bridge & Iron Works

No. 5 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

sides of the tank, and the rolling ladder which leads down to the floating roof. The seal constructions shown in Figs. 2 and 3 are effective in eliminating vapor loss except during a high wind. The pontoon ring is sufficiently large to give stability even when water or snow accumulates on the roof. The roof slopes to the center for drainage of water but the thickness of the floater ring is enough to provide a recess under the center of the roof for the accumulation of such vapor as may be evolved during periods of high temperature. Adjustable legs are attached beneath the roof so that it will not rest on the bottom when the tank is completely empty, and so that some space is available for cleaning the tank.

A somewhat less elaborate roof construction is shown in Fig. 1. It is referred to as a pan-type roof or simply as a floating roof. It lacks the stability of the pontoon roof and provides no space for the accumulation of vapor but it is much cheaper. Since it only covers the surface of the liquid and cannot keep the vapor from escaping, it is not recommended for gasolines.

In gaging floating-roof tanks, a correction must be included for the oil that is displaced by the roof Every floating body, including a pontoon roof, displaces a volume of liquid equal in weight to the weight of the object. Even the vapor caught under the roof does not affect the liquid level in the gage hatch because variations in the amount of vapor only change the net weight of the roof and its height in the liquid. This somewhat strange behavior has been checked by experiments. Thus, gaging is done in the regular manner except that a quantity of oil corresponding to the weight of the roof is subtracted from the gage reading. The weight of each floating roof is stamped on a plate on the roof manhole cover. The volume of oil to be subtracted from the gage reading may be computed by dividing the weight of the roof (including water or snow on it) by the density of the liquid without correction for temperature.

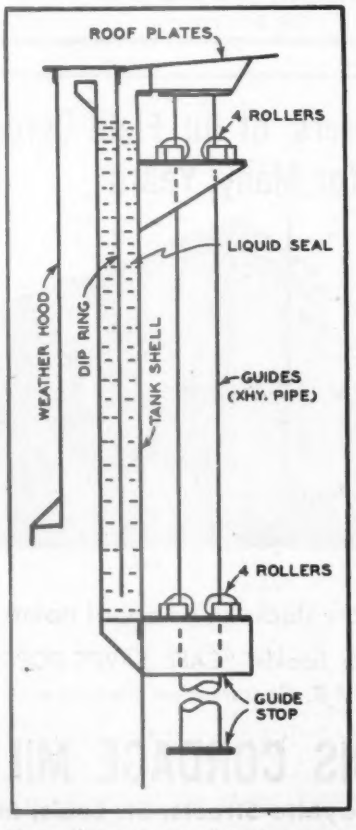


Fig. 4: Detail of seal of the Graver expansion roof

Example of Roof Correction

A large gasoline tank has a roof that weighs 60,000 lb. The gasoline in the tank is at 80° F. and its gravity without correction to 60° F. is 59° A.P.I. The weight of a 59° A.P.I. material is 6.184 lb. per gal. The roof correction is 60,000 divided by 6.184 or 9,702 gal. This correction should be subtracted from the volume obtained by the tank gage and before correcting the gage volume from 80° F.

If the tank volume has already been corrected to 60° F. then the density of the oil at 60° F. should be used in computing the roof correction. Thus, at 60° F. an oil whose gravity at 80° F. is 59° A.P.I., will have a gravity of 56.8° (see Tag. Manual) and a weight of 6.256 lb. per gal. The correction then becomes 60,000 divided by 6.256 or 9,591 gal.

Expansion Roof

The Graver expansion roof whose seal is shown in Fig. 4 is a sealed tank but its roof can move up and down with variations in the amount of vapor. For this reason it is also discussed in No. 6 of the Notebook under the title of "Gas-Holder Systems." In this construction, the roof rests in a separate oil seal compartment rather than in the liquid contained in the tank. Thus, no gaging correction is necessary. Stability is attained by means of a number of rods (pipe) or guides extending down from the roof near the walls of the tank. These guides slide up and down through rollers as the roof moves.

OUTLINE OF REFINER'S NOTEBOOK TOPICS

HUNDREDS of scarcely related topics could be discussed in The Refiner's Notebook. The order in which these many topics will be discussed will be based somewhat on the flow of the crude oil through a refinery. Thus, the storage of refinery feedstocks requires about 11 installments followed by discussions of crude oils to the amount of about 7 installments. Succeeding topics each of which will require several installments are topping plant flow, yields of products, crude settlers, exchangers, pipe-still heaters, stacks, fuels, towers, pipe and fittings, pumps, condensers, coolers, pressure drops, blending plants, etc. To some extent the discussions of each general topic will overlap each other. For example, the discussions of crude oils is introduced in page 9 even though the discussion of storage is not yet complete.

Tentative outline of Refiner's Notebook (No. 1 to No. 10):

No. 1 Storage of Feedstocks.

No. 2 Evaporation in Crude Storage.

No. 3 Stabilization and Gas Recovery.

No. 4 Fixed-Roof Tanks.

No. 5 Eliminating Vapor-Space in Storage Tanks.

No. 6 Gas-Holder Systems.

No. 7 Volatile-Liquids Storage.

No. 8 Strength of Tanks and Heads.

No. 9 Mixed Base Crude Oils.

No. 10 Tank Strapping Tables.

At intervals of 4 to 6 weeks similar schedules will be published.

Practical and operational subjects are the aim of The Refiner's Notebook. Nevertheless, what is practical for the plant chemist may not be at all practical for the shift foreman, young engineer, plant superintendent, maintenance department, etc. For this reason a great variety of topics will be discussed. After a foundation knowledge has been established the Notebook will tend more and more to discussions of plant operation and the maintenance of equipment.

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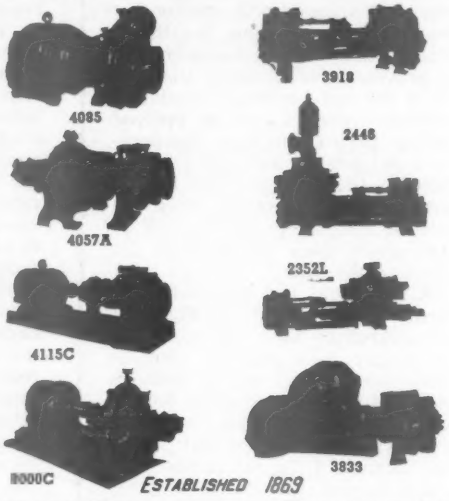

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SQUEEZE-CEMENTING METHODS

THE process of squeeze cementing usually involves the use of a cement retainer. A cement retainer is a special type of packer equipped with a back pressure valve. When run into a well it is attached to a circulation joint which is connected in turn to drill pipe or tubing.

The packing and back-pressure valve of the retainer serve the twofold purpose of keeping the high pressure off the upper part of the casing string and holding the pressure on the formation until the cement sets. The circulation joint allows fluid to be pumped either through the retainer or into the casing space around the tubing or drill pipe as desired. This is an essential part of the hookup since it furnishes a convenient means of getting the cement slurry to the bottom of the tubing or drill pipe string without forcing excessive water or mud through the retainer and into the formation ahead of the cement.

Left-Hand Threads

The circulation joint is attached to the retainer by left-hand threads. This allows the removal of the circulation joint and tubing string from the well at the completion of the squeeze job. The retainer is made of drillable material that can be drilled out after the cement has set.

In placing the retainer in the casing, it is run into the well to the desired depth. The running-in string and the annular space are filled with water or mud. A tripping ball is then dropped down through the running-in string. The ball comes to rest on a seat in the retainer. Pump pressure is then applied to the running-in string at the surface and is transmitted to the retainer which is closed by the tripping ball. Continued increase in pressure forces the rubber packing out against the casing wall and also shears pins which hold a set of segmented slips and forces the slips along a tapered surface causing them to engage the inner wall of the casing. Further increase in pressure shears another pin and allows the tripping ball and its seat to fall to the bottom of the well. This in turn releases the back pressure ball in the retainer which will prevent upward movement of fluid through the retainer.

The setting operation is then completed by pulling upward on the running-in string at the surface. This compresses the rubber packing and sets the lower slips so that the retainer cannot move either upward or downward and a pressure-tight seal is formed against the casing. The circulation joint, immediately above the retainer, may be closed or opened at any time by applying or relieving strain on the pipe.

With the circulation joint open, water is pumped into the tubing or drill pipe until returns are obtained through the casing annular space. The circulation joint is then closed and enough water is pumped through the retainer to "break down" the formation*. The maximum break-down pressure and the subsequent minimum pressure are noted. The differential between these two pressures often gives an indication of the amount of cement that should be used.

Displacement of Water

Cement having a density of about 15 lb. per gallon is then pumped down through the tubing with the circulation joint open to allow displacement of water from the tubing into the annular space. By volumetric calculations, it can be determined at what point the circulation joint should be closed to allow introduction of cement slurry through the retainer into the formation. When, during the introduction of cement slurry, the pressure builds back up to the break-down pressure, the job is usually considered complete. If any excess cement remains in the tubing at that time, the circulation joint can be opened or unscrewed from the retainer and the excess slurry circulated out of the hole. If introduction of all the slurry does not cause the pressure to again reach the value at break-down, it may be necessary to introduce another batch in order to shut off the water or gas, as the case may be.

If there is any doubt that casing is securely cemented around the shoe, it is desirable to set the retainer about 50 to 100 ft. above the bottom of the casing. Otherwise, the high squeeze pressure may be transmitted upward around the outside of the casing and collapse the casing above the point where the retainer is set.

Types of Cement

Slow-setting cements should be used where bottom-hole temperatures are high. Common portland cement can be used in low-temperature zones, particularly if multiple-batch technique is applied.

After the cement retainer and set cement are drilled out of the hole, the soft cement adjacent to all pay zones can usually be removed by swabbing and washing the hole. A wall scraper will aid in properly cleaning a hole, if the other methods fail.

A cement squeeze can be applied through perforations in casing as well as to open hole below the casing. Sometimes, a sludge composed of cement and drilling mud will be left behind perforations after a squeeze job and will clog the perforations so that the well will not produce oil properly. If the sludge is composed principally of drilling mud, the injection of quebracho solution or some other deflocculating agent under high pressure may break down the sludge and allow its removal. If the clogging material is chiefly cement, the introduction of a 15 per cent solution of hydrochloric acid will clear the perforations. Acid should be used sparingly and cautiously for this purpose, however, since it may destroy the results of a good squeeze job by removing the cement that excludes the gas or water.

*See Installment 147.

Series prepared by Glenn M. Stearns, associate professor of petroleum engineering, University of Oklahoma

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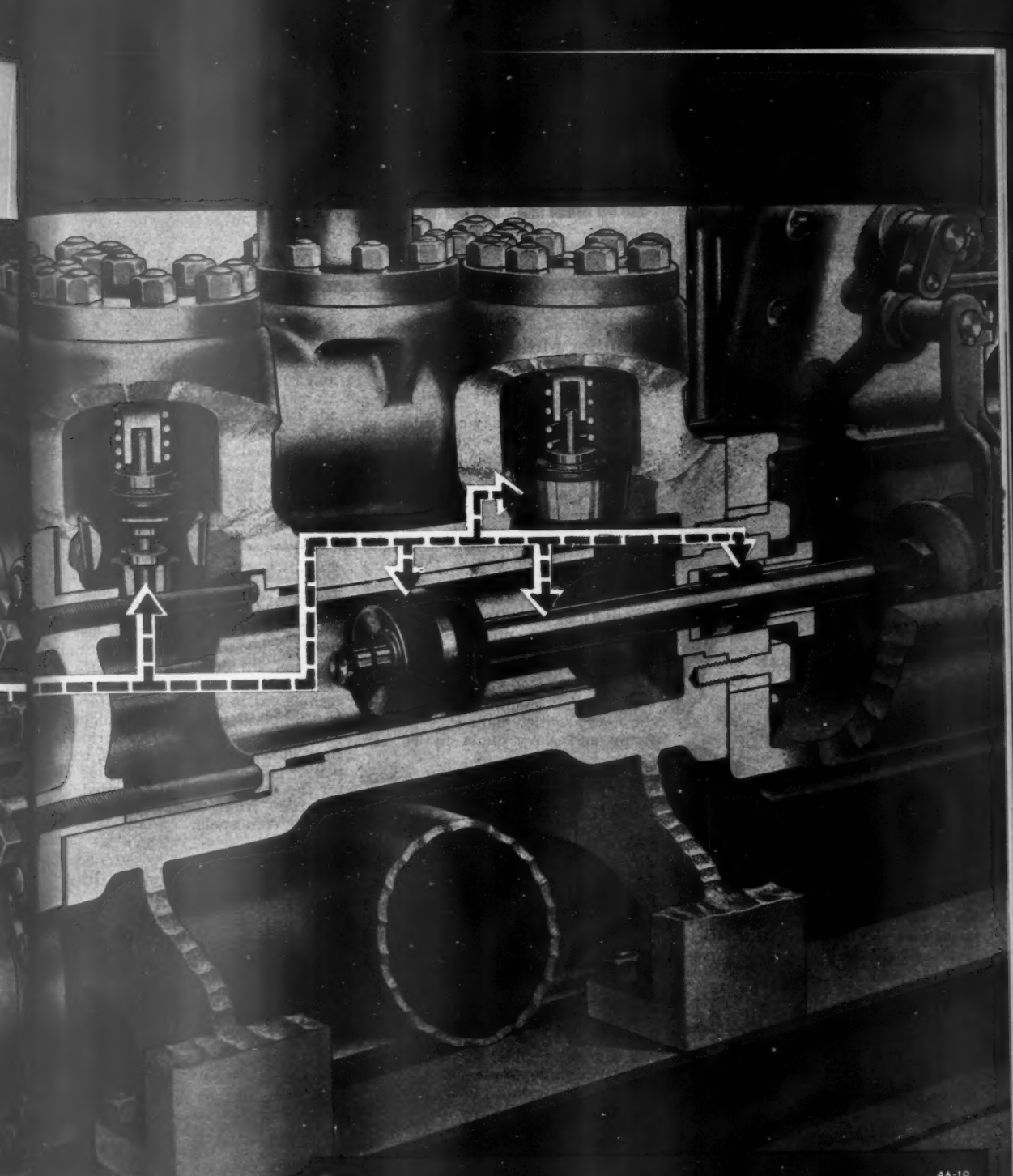

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REFINING

Frontier Makes Record for Continuous Operation

CHEYENNE, Wyo. — By starting on its sixty-fourth day of continuous operation since it went on stream the Frontier Refining Co.'s 100-octane gasoline plant established a record among the 40 government-sponsored refineries now producing aviation fuel for war use.

Officials of the company said there was no reason to believe the refinery run would be interrupted in the near future. The 64-day run has enabled Frontier to more than meet its Army-Navy production quotas for June and July, at a time when accelerated war activities are multiplying the need for 100 octane.

In its first month of production, the new Frontier plant exceeded its Army and Navy quota by 60 per cent.

Technicians are conducting a survey of the company's 100-octane plant to determine what materials would be necessary to convert facilities to black-oil operation. The changeover is contemplated because available supplies of green oil are dwindling, the company says.

The average refinery cannot run black oil because it contains sulfur and will eat tower linings and other vessels, eventually making them unstable. There are other technical reasons why it is necessary to make extensive conversions if black oil is to supplant green oil in the refinery run. The study under way is expected to determine whether it is practical to allocate funds and materials for converting the DPC-financed plant to black-oil operation.

District 2 Refiners Told to Share Crude Supplies

CHICAGO. — Petroleum Administration for War has sent directives to 21 refiners in District 2 asking them to share a total of 28,620 bbl. of crude oil daily with 21 other refiners in the district in August, under the wartime crude-allocation program.

This is the largest number of crude-donor companies involved in the program in 6 months and also is a larger volume of crude than in the last few months. It compares with 24,175 bbl. daily and 17 suppliers in July; 27,350 bbl. and 16 in June; 27,535 and 16 for May; 29,350 and 20 for April; 46,600 and 21 for March; 47,590 and 20 for February; and 64,690 and 28 for January.

The telegraphed directive asserted most effective utilization of petroleum requires that crude oil in District 2 be allocated among refiners; therefore, the refiners are directed to share as indicated.

Sinclair Starts Survey for Refinery in Venezuela

NEW YORK. — George H. Taber, vice president in charge of refining for Sinclair Refining Co., has arrived in Venezuela with a group of technicians to begin surveys for the 35,000-bbl. plant which the company plans to construct at Puerto la Cruz in that country, near the company's pipe-line terminal. Crude oil for the refinery will be carried by pipe line from the Santa Barbara field in Venezuela.

Plant to Be Reconverted to Aviation-Gasoline Use

HOUSTON. — Eastern States Petroleum Co.'s plant, converted to manufacture of butadiene, constituent of synthetic rubber, is to be partly dismantled and reconverted as a step in supplying extra feed stock for aviation gasoline, according to H. H. Chancellor, engineer for the Defense Plant Corp.

The butadiene plant was constructed by Eastern States under an operating contract with DPC, and it is the first DPC plant in this area to be abandoned.

Contract for the dismantling has been awarded and Chancellor said he expected the project to get under way immediately.

O.W.I.U. Made Agent for Crown Central Workers

HOUSTON. — Workers at Crown Central Petroleum Corp.'s refinery have chosen Oil Workers International Union (C.I.O.) as their bargaining agency. Clyde Ingram, secretary of the local union, said that with about 285 eligible voters, 244 ballots were cast, giving the Oil

Workers 189; Hounston Labor and Trades Council (A.F.L.), 9, and International Brotherhood of Firemen and Oilers (A.F.L.), 37. Nine persons voted for no organization.

Crown Central was one of the few oil refineries in this area not already bargaining with the Oil Workers union, Ingram said, and the election was the result of an organization campaign conducted by the local. He said it was expected that the local would begin negotiations with the company as soon as official certification was received from the National War Labor Board.

Continental Plant to Be in Full Operation Soon

PONCA CITY, Okla.—Repair work is under way at the 100-octane gasoline plant of Continental Oil Co., where damage, the extent of which has not been estimated closely, was inflicted by an explosion and fire. Dr. Walter Miller, vice president in charge of manufacturing, said Continental would be producing aviation gasoline again within 10 days or 2 weeks.

The explosion, of undetermined origin, wrecked the isomerization reactor tower. This vessel, 7½ ft. in diameter and 66 ft. high, was blown partly over a water-cooling tower 40 ft. high, landing about 120 ft. from its normal location.

In an article published in the current issue of the Red Triangle, the company's house organ, and written before the explosion, Doctor Miller says: "Continental Oil Co. is now producing enough 100-octane aviation gasoline to send 370 heavy bombers on round-trip flights from London to Berlin every day. More than a billion gallons of all kinds of petroleum products are being produced yearly by all of Continental's nine plants, by far the larger portion of which is going directly into the war effort."

Gulf Coast Gasoline Stocks Record Slight Upturn

HOUSTON. — Gasoline stocks of the 11 active companies in Gulf Coast Refiners Association recorded a mild upturn in the second half of July, standing at 1,218,915 bbl., an increase of 54,494 bbl. over the inventories reported on July 1. On August 1, 1943, total gasoline stocks held by the same group of refiners were 1,744,625 bbl. and on the corresponding date 2 years ago the total stocks were 2,665,690 bbl., or more than double the present inventory.

Automotive gasoline stocks considered alone were 526,226 bbl. on August 1, indicating an increase since July 15 of 76,348 bbl. This total represents about 68 per cent of the 764,008 bbl. of automotive gasoline held in inventory at this time last year, but it represents only 29 per cent of the 1,810,186 bbl. in hand August 1, 1942, when such stocks were considered about normal.

Kerosene stocks at 170,788 bbl. on August 1 indicate a decrease of 2,751 bbl. during the period. Diesel gas-oil stocks August 1 were 100,660 bbl., an increase of 49,582 bbl. Stocks of several other grades of gas oil increased 66,113 bbl. from 763,464 bbl. July 15 to 829,577 bbl. August 1.

Stocks of heavier fuels showed some change. No. 5 fuel oil reported at 246,112 bbl. increased 90,721 bbl. and Bunker C fuel oil stocks at 410,816 bbl. were an increase of 79,337 bbl. during the period. Cut-back asphalt stocks were reported at 25,873 bbl.

Total stocks of all products in the refineries of the GCRA group were reported at 3,200,447 bbl. on August 1, an increase of 305,908 bbl. during the last half of the month. A year ago total stocks were 3,197,398 bbl. when crude runs were at a greatly reduced rate. Stocks of total products at this time 2 years ago were 5,866,079 bbl.

Operations continued at a high level, with crude-oil throughput at the 11 operating plants averaging 119,090 bbl. daily, compared with 118,676 bbl. during the first half of the month. Crude runs were maintained at 85 per cent of present rated capacity of 146,500 bbl. This represents an increase of 42,903 bbl. daily, compared with operations of 60 per cent of capacity a year ago when the GCRA group processed 76,187 bbl. a day during the second half of July. During the same period in 1942 crude runs were at the rate of 94,000 bbl. a day.

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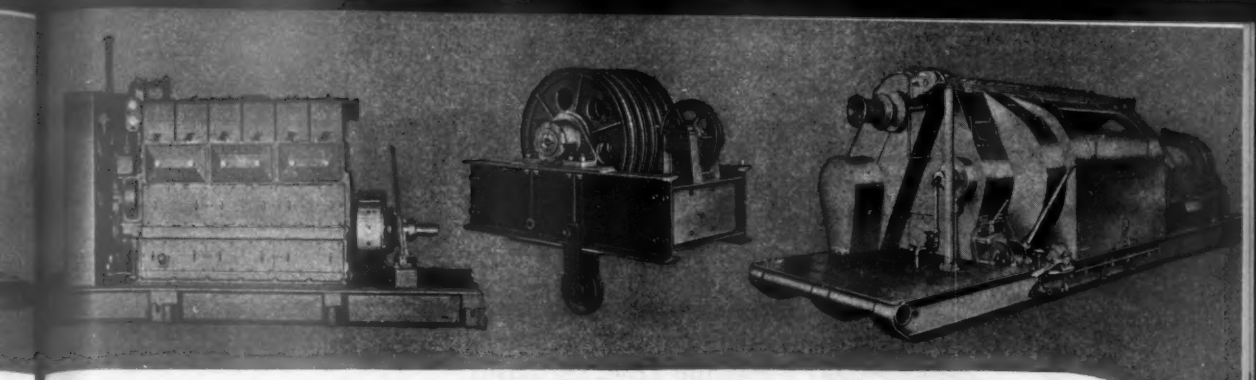

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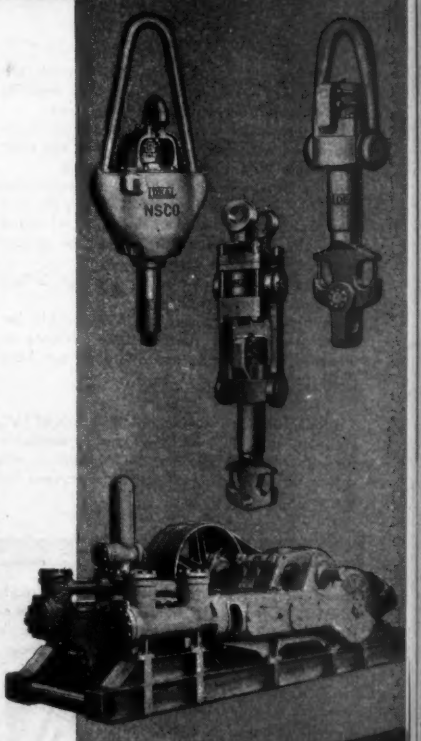

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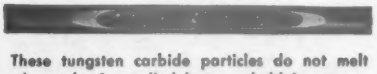

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PIPE LINES

Stanolind Lays Elk Basin Line at 2½ Miles Per Day

The three gangs building the Elk Basin-Casper, Wyo., crude-oil line of Stanolind Pipe Line Co. have laid approximately 145 miles of this 232-mile 12-in. project, which is proceeding at the rate of 2½ miles per day.

Contract Awarded for Iles-Wamsutter Line

Utah Oil Refining Co. has awarded contract for a 110-mile 6-in. crude-oil line from Iles dome, Colorado, to the Wamsutter, Wyo., pump station on the company's Wyoming-Utah trunk line to Eastern Construction Co. Supervision of the project will be handled by Stanolind Pipe Line Co. on the same basis as that for the Utah company's 442-mile 8-in. trunk line between Fort Laramie, Wyo., and Salt Lake City, Utah.

Eastern Construction Co. is reported to be a partnership trust of C. Hobson Dunn, pipe-line stringing contractor; J. W. Arthur, and Curtis E. Hill, nephew of Senator Hill of Mississippi. For certain legal reasons, Parkhill Trucking Co. has been nominated by Eastern Construction Co. to handle stringing. Much of Eastern's equipment has been acquired from Oklahoma Contracting Co. The Parkhill Company has been stringing pipe for Stanolind's Elk Basin line now under construction. Midwestern Engineers has contracted to build parallel telephone and telegraph lines.

A significant aspect of the project is that 100 tank cars will be released for service elsewhere. It is believed that this factor influenced War Production Board in reaching a decision to approve the line. The new line will serve as a pipe-line outlet for two pools, the larger of which is the Wilson Creek pool. Existing lines connect the Wilson Creek and Iles pools with Craig, Colo.

Equipment is now on its way to the project. Bulldozer work on the right-of-way is to start August 20; ditching August 22, welding August 24.

Laying is to be done by two gangs, one going south from Wamsutter and the other north from Iles. It is expected that faster progress will be made by the gang going south through Wyoming, which will probably lay 60 miles of line by the time the Colorado gang has laid 50 miles in traversing rougher country.

Eastern Construction Co.'s headquarters are at 216 Mercantile Building, Dallas. No announcement has been made regarding the location of field offices but it seems likely that the company will have an office at Craig, Colo.

Present equipment will be utilized for the Iles-Wamsutter line at an initial station. Later an intermediate station may be necessary. However, the project will make it necessary to add a third pumping unit at the Wamsutter and Granger stations of a type similar to the two units now in service at each of these stations. Contract for building a 20,000-bbl. floating-roof tank at Wamsutter station has been let to Chicago Bridge & Iron Co.

Magnolia Plans New Facilities

Magnolia Pipe Line Co. is expanding its carrier system which serves the Fullerton deep pool of northwest Andrews County, in the West Texas Permian basin. The company will install 5½ miles of 6-in. line to loop its 4-in. line which connects the pool with the company's main north basin system. The loop will boost the line's capacity to 21,000 bbl. daily. The Fullerton pool now has 70 wells producing from 7,000 ft. or deeper with a daily allowable of approximately 8,500 bbl.

Sinclair Prepares for 650-Mile Products Line

Right-of-way and ground for terminal facilities are being acquired by Sinclair Refining Co. for a large products pipe-line system which has been estimated to total 650 miles. This is said to include a line from Wood River, Ill., to Steubenville, Ohio, by way of Columbus, Ohio, which will connect with company's present products line from Steubenville to Marcus Hook, Pa. The present Sinclair line from East Chicago to Toledo, Ohio, is to be extended to connect with the Wood River-Steubenville line at Columbus.

Operations of Sinclair Refining

Co. for the project are being directed by W. W. Baker from offices at 606 Huntington Building, Columbus. The company has acquired a 100-acre tract for terminal facilities at Columbus. Right-of-way has been negotiated at several points.

Products are to be shipped from Kansas City by barge down the Missouri River to enter the contemplated line at Wood River.

Reports from Ohio sources denied that the project was planned for immediate execution. Company officials said no definite move has been made toward any immediate developments, and they doubted whether government authority could be obtained in the war period in any event.

PAW Reports Progress on Eight Pipe-Line Projects

WASHINGTON. — Petroleum Administration for War provides information concerning eight pipe-line projects in its current weekly report on progress. The projects follow:

Project 23.—Yale's 82-mile 6-in. and 8-in. Elk Basin line. Forty miles of pipe strung and 37 miles laid on 8-in. line from Warren to Yellowstone River, near Billings; 12½ miles of pipe remain to be laid. All three pump stations have been completed except for small miscellaneous items. Two 5,000-bbl. tanks at Elk station and four 10,000-bbl. tanks at Warren station have been erected. Two of the 55,000-bbl. tanks at Yellowstone station are completed and the third is three-quarters constructed.

Project 24.—Stanolind's 232-mile 12-in. line, Elk Basin to Casper. On this job, 124 miles of pipe now strung and 57 miles laid. Tank grades at Elk Basin station completed. Scheduled for completion in September.

Project 25.—Ohio Oil Co.'s 115-mile 8-in. products line from Robinson, Ill., to Indianapolis. Ninety per cent of right-of-way purchased and entire route staked. Work will start in September.

Project 26.—Pan American's 36-mile 8-in. crude line from Willamar to Port Isabel, Tex. All right-of-way procured and cleared; 26 miles of line completed.

Project 28.—Texas Co.'s 34-mile 6-in. products line from Lockport, Ill., to East Chicago, Ind. All pipe laid except about 2 miles. Pump station at Lockport 98 per cent erected. Part of line tested. It is expected that approximately 9,500 bbl. per day of products will be delivered to the Sinclair East Chicago-Toledo line for movement to Toledo in August.

Project 29.—Colonial Beacon's 35-mile 4-in. and 6-in. products line from Everett to Lawrence, Mass. About 23½ miles of right-of-way obtained and 55 per cent of route staked.

Project 30.—Construction by Stanolind Pipe Line Co. of 41 miles of 16-in. loops along existing crude-oil system between Drumright, Okla., and Sycamore, Kans. Construction contracts awarded and preliminary work started July 22. First shipment of pipe received July 26 and stringing operations have started.

Project 31.—Construction by Utah Oil Refining Co. of 112 miles of 6-in. crude pipe line from Iles Dome pool, Colorado, to Wamsutter station, Wyo. Construction will start in September. Scheduled for completion in December or January.

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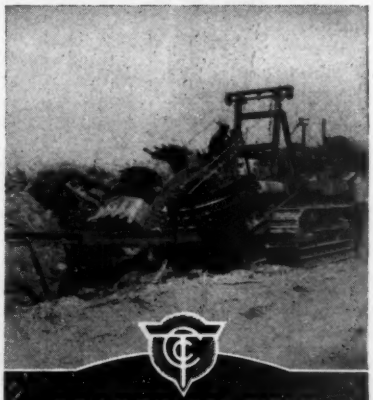

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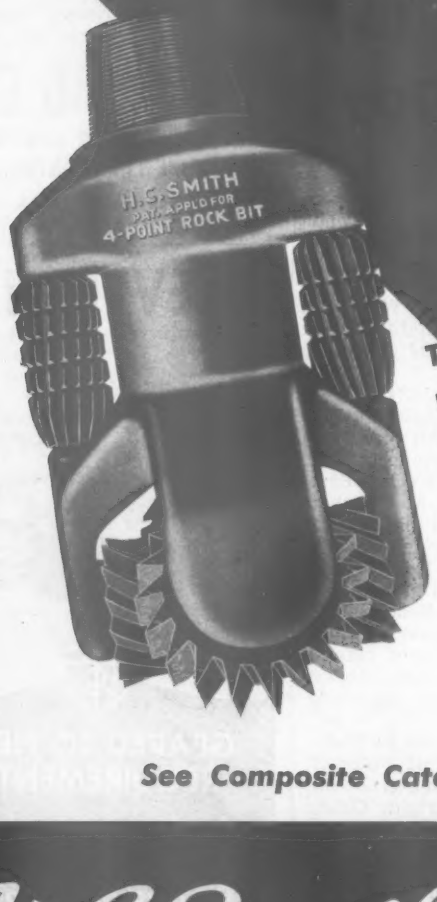

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Natural Gas

United Gas Plans Line to Cross Ouachita River

SHREVEPORT.—United Gas Pipe Line Co. has filed with the U. S. Engineer Office in Vicksburg, Miss., an application for permission to lay an 8-in. natural-gas line across the Ouachita River 1,400 ft. downstream from the mouth of Bayou Bartholomew and 201.1 miles above the mouth of the Black River.

Commercial Rates Reduced By Oklahoma Natural

OKLAHOMA CITY. — The State Corporation Commission last week approved a substantial reduction in natural-gas rates for large commercial consumers served by Oklahoma Natural Gas Co. The cut, which runs to 30 cents per thousand ft. for consumers using in excess of 500,000 cu. ft. becomes effective October 1.

Under the step-rate application approved, the new rates will be, for the first 100,000 cu. ft., 45 cents, as now; the next 400,000 cu. ft., 18 cents, now 45 cents; all over 500,000 cu. ft., 15 cents, now 45 cents.

Columbia Subsidiaries Plan Extension of Facilities

WASHINGTON. — Federal Power Commission will hold a hearing August 30 on applications filed by Cincinnati Gas Transportation Co., United Fuel Gas Co., and Warfield Natural Gas Co. for authority to construct additional facilities in Kentucky and West Virginia. All three companies are subsidiaries of Columbia Gas & Electric Corp. and all have their principal offices in Charleston, W. Va. The projects follow:

1. Cincinnati Gas Transportation Co. proposes to construct an 8-in. pipe line, 400 ft. in length, with a measuring station and appurtenant facilities at Leach, Ky., to permit delivery of natural gas from the Tennessee Gas & Transmission Co.

2. Warfield Natural Gas Co. proposes to construct two 10-in. pipe lines, a measuring station and appurtenant facilities near Burnaugh, Ky., one line extending 1,350 ft. from the Tennessee Gas & Transmission Co.'s line in a westerly direction to connect with Warfield's existing line, and the other extending 2,034 ft. in an easterly direction to connect on the west side of the Big Sandy River with a 10-in. line which United Fuel Gas Co. plans to construct.

3. United Fuel Gas Co. proposes to construct (a) a 10-in. pipe line, 1,995 ft. in length, extending from an interconnection with Warfield's proposed line in an easterly direction across the Big Sandy River to an existing 20-in. line owned by United; (b) a 12-in. pipe line, 450 ft. in length, at Cincinnati Gas Transportation Co.'s Kenova compressor station, to transport natural gas to be received from Tennessee Gas & Transmission Co. to United's line and thence to The Ohio Fuel Gas Co., with appurtenant facilities, including a 20-in. gas-mixing chamber; and (c) a pipe line consisting of 32,800 ft. of 12-in. and 4,000 ft. of 16-in. pipe, extending from a point on the Tennessee Gas & Transmission Co.'s 20-in. line, in Kanawha County, West Virginia, in a northerly direction to United Fuel Gas Co.'s Lewis compressor station in Roane County, West Virginia, with an appurtenant measuring station structure and equipment.

Rubber Industry Warned of Channel-Black Shortage

WASHINGTON. — Increased demand for easy-processing channel carbon black has reduced production in the channel black industry by approximately 15 per cent, and the Chemicals Bureau has requested the rubber industry to replace easy-processing channel-black requirements with medium-processing channel black to the fullest possible extent.

Where direct substitution is not possible, Chemicals Bureau officials suggest a blend with semireinforcing furnace or high-modulus furnace, or use of high modulus alone. Officials said that this could be done without any loss of quality in the finished product and in many cases would result in an improvement.

Because of rising demands, Chemicals Bureau officials said it had been necessary in many cases to deny or cut August allocations for channel carbon black.

This situation is expected to be cleared up by the end of the year, officials explained, since new production of both channel and furnace carbon blacks is scheduled to be brought in each month. Enough carbon black is being produced and in stock to meet 1944 requirements fully, it was asserted.

Since January 1, 1944, production of all grades of furnace carbon black has been increased from less than 100,000,000 lb. a year to more than 430,000,000 lb. When the present program is completed in the early part of 1945, production will be at a rate of 625,000,000 lb. a year, officials said.

Channel-black production also is being increased monthly. By March 1945 it should be at a rate of over 600,000,000 lb. a year, bringing the grand total of more than 1,200,000,000 lb. of all black for the rubber industry.

Chemicals Bureau officials said short supplies of natural gas and state restrictions have delayed production of easy-processing black to such an extent that 1945 rubber requirements for easy-processing black have been reduced by 50,000,000 lb. This has been balanced by an increase in the requirement for furnace black.

Ask for Exception on Rule For Metering of Gas

AUSTIN. — The State Railroad Commission set Friday, August 18, as the date for a hearing on the application of Smith Brothers Refining Co. for an exception to the statewide rule on metering of gas, so it could introduce casinghead gas into its sour gas line serving carbon-black plants in the Panhandle.

Natural Gasoline

Peppers Starts Work on Plant at West Edmond

OKLAHOMA CITY. — Peppers Gasoline Co. has started work on construction of a natural-gasoline plant at West Edmond, first project of the kind in that tricounty field. The plant, on the French lease in NE NW of 33-14n-4w, will have capacity of 10,000,000 cu. ft. of gas a day. Portions of a gathering system already have been laid in the field. Gas in the field treats out an average of 1 gal. of gasoline per 1,000 ft.

Peppers also is constructing an office building, and contemplates construction of homes for employes.

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Exploration and Drilling

Week's Highlights

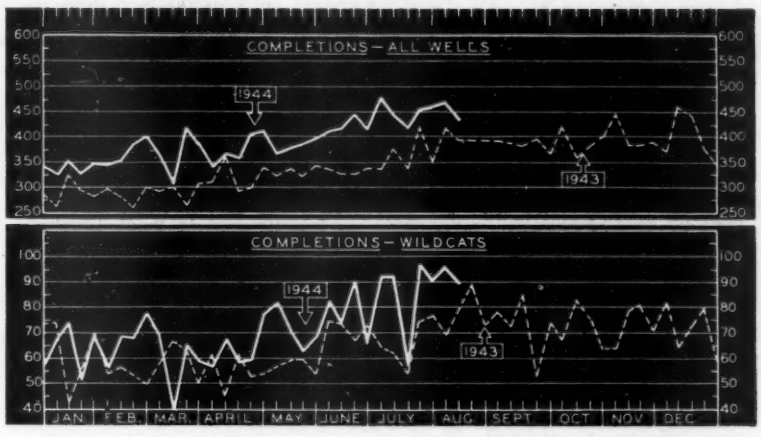
ONE of the byproducts of the progress made by geologists and petroleum engineers is trouble for the legal profession. The recent Lake Creek field decision by the Texas Railroad Commission is an example.

The problem involved the question of proper procedure to promote conservation of the hydrocarbons intermediate between oil and gas, called "condensate." In the reservoir, under pressure, they exist in vapor form, but at the surface, when the pressure is released, they condense to a liquid. If the reservoir pressure drops below a certain point, much of the condensate will liquefy, saturating the sand body, after which only part of the liquid can be recovered by known producing methods.

The Texas Legislature does not try to keep the law abreast of geological and engineering progress by specific legislation on each case. Instead it gave the commission a broad statutory grant of authority. The statute is a declaration of legislative policy and authorizes the commission to act as a combination legislative, executive and judicial agency to keep abreast of the geologists and engineers.

This usually works fairly well, but while the statutory policy regarding oil and regarding gas is reasonably clear, it did not specifically take into account the intermediate "condensate," and some of the policy declarations regarding gas might be interpreted as conflicting with what the commission deemed advisable in the Lake Creek case. Gas conservation and its economic utility in recovering both condensate and oil is of increasing interest to engineers. Some contend that broadening of the statutory authority of many state commissions is necessary.

The legal profession has the task of building a structure that maintains the principles of relative equity among individual property rights and between individual rights and public interest. This can only be built on the foundation agreed upon by engineers and geologists, yet these two groups are constantly changing that foundation by their progress, and this upsets the balance of the existing legal structure.



Solid line charts current weekly completions

COMPLETIONS IN ALL FIELDS . . .

(Week ended August 12, 1944)

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1944	1943
N. Y., Penna, W. Va.	48	23	3	74	139,310	2,004	2,071
Ohio	4	8	7	19	47,056	586	524
Indiana	3	0	5	8	16,137	135	137
Kentucky	8	0	10	18	43,207	426	233
Illinois	31	0	23	54	140,793	1,104	1,067
Michigan	6	2	6	14	37,647	378	340
Kansas	10	2	10	22	78,777	1,072	984
Nebraska, Missouri, Iowa	2	0	0	2	3,888	21	29
Oklahoma	17	2	14	33	118,720	1,033	698
Texas:							
North Central	13	0	13	26	96,216	873	833
West	29	0	1	30	130,134	913	508
Panhandle	2	0	0	2	6,498	130	113
Eastern	5	0	2	7	50,006	202	174
Gulf Coast	16	0	7	23	151,007	709	269
Southwest	6	0	10	16	62,621	443	553
Total Texas	71	0	33	104	496,482	3,270	2,450
Louisiana:							
Northern	1	3	4	8	37,776	179	194
Southern	7	0	4	11	112,280	294	227
Total Louisiana	8	3	8	19	150,056	473	421
Arkansas	2	1	5	8	36,384	136	148
Mississippi	1	0	0	1	4,829	81	55
Southeastern States	0	0	0	0	0	21	†
Montana	5	2	3	10	29,584	198	127
Colorado	0	1	0	1	7,005	19	18
Wyoming	3	0	1	4	18,840	98	74
New Mexico	8	1	3	12	31,928	239	128
California	25	2	3	30	134,648	1,196	784
Total U. S.	252	47	134	433	1,535,091	12,490	10,288
Total previous week	254	42	174	470			
Total Aug. 14, 1943	211	39	142	392			

*Does not include 45 pressure wells. †Included in total shown for Mississippi.

CALIFORNIA

Standard Establishes New Deep Drilling Record

LOS ANGELES.—Standard Oil Co. of California has established a new drilling record in its 20-13 Kern County Land, an outpost at the northwest end of the Coles Levee field, with the bit going ahead at 14,711 ft. This is the deepest hole drilled by Standard in California and it is the deepest test in the South Coles Levee field. Favorable indications have been noted, but the possibility of getting production below the Stevens of Miocene age appears remote. No definite depth has been set at which to stop drilling, as much depends upon the formation and the condition of the hole.

It may not be long before Elk Hills and Buena Vista Hills top the development list in California, provided operators are able to get drilling contractors to concentrate efforts in these fields. Standard, which is doing the development work for the Navy Department at Elk Hills, hopes to have 15 strings of tools in operation quickly and has as its objective the completion of one well daily until the development program has been finished. Substantial acreage has been proved up in the lower zone at Buena Vista Hills but operators still are drilling extension wells to determine how extensive the lower zone may be. Standard appears to have established the western and northwestern limits.

The objective at Elk Hills is development of 50,000 bbl. additional production to bring the field's output up to 65,000 bbl. daily. The number of wells necessary to accomplish this goal will depend upon how they hold up. Many are inclined to believe that it will not be necessary to drill 300 wells as outlined in the Standard-Navy agreement.

General Petroleum Corp. is not experiencing much luck with its wildcat in the Buena Park area. Just how much oil sand was found in this wildcat is not known, as core recovery was poor. The sand found looked excellent. This wildcat was drilled to 11,422 ft. and later plugged back to 11,200 ft. A solid string of 5½-in. was landed and cemented at 11,000 ft. The company is sharpshooting at predetermined points as it will not be possible to test very much of the interval at a time.

Shell Oil Co., Inc. at Seal Beach appears to have the making of a commercial well north of the Seal Beach fault and has landed a string of 7-in. in 5 Bryant. The interest that attaches to Shell's outpost lies in the fact that until recently little production has been developed north of the Seal Beach fault. The test has been bottomed in the MacGrath zone at 7,848 ft., with a water string cemented at 6,860 ft.

CALIFORNIA WILDCAT OPERATIONS

Dominguez outpost, Los Angeles County: Macmillan Petroleum Corp. 1 Darling, 35-3s-13w, dry hole at 8,466 ft.

Rosecrans-Dominguez outpost, Los Angeles County: Standard of California 1 Bell Comm., 29-3s-13w, dry at 9,134 ft.

Inglewood outpost, Los Angeles, Shield Petroleum Co. 1 Bernard, 18-2s-14w, dry at 3,603 ft.

TEXAS GULF COAST

Needville Deep-Sand Well Testing New Levels

HOUSTON.—Outpost and deep-sand discovery well in Needville field, Fort Bend County, British-American Oil Producing Co. 1 Ed Hurta et al, is testing in new perforations at 6,025 to 6,029 ft. This well showed for production in perforations at 6,547 to 6,552 ft. and showed oil and salt water at 5,201 to 5,208½ ft.

Humble Oil & Refining Co. 1 Sodak Oil Co., Livingston field, Polk County, is completed in perforations at 6,069 to 6,075 ft., but fails to flow continuously so will be pumped for new potential. Wilcox sand was topped at 6,068 ft. Total depth is 7,696 ft. in sandy shale, with a plugged-back total depth of 7,005 ft. The well flowed 35.22 bbl. in 3 hours on ½-in. choke with tubing pressure 60 lb., casing pressure 800 lb., gas-oil ratio 129 to 1, gravity 36° and no water. The 5½-in. casing was set to 7,148 ft.

After an inactive period of many months, Humble is starting a test in the Redfish Reef area of Galveston Bay, Chambers County. It is the 33-A State-Galveston Bay, in Section 246. This well set 16-in. casing at 106 ft. Operators are preparing to drill ahead from 117 ft.

Humble is running production test at its 33 Granbury, Wilcox test, at Livingston field, Polk County, after setting 2-in. tubing to 7,032 ft. It is cleaning on ¼-in. choke, showing 60 per cent oil and 40 per cent water, with tubing pressure of 900 lb., casing pressure 725 lb. Total depth is 7,090 ft., with 5½-in. casing set at 7,087 ft.

Deepest test to be drilled in the old Pierce Junction field, just southwest of Houston in Harris County, is Gulf Oil Corp. 1 C. S. Settegast et al, on a 320.36-acre lease in Joseph Kopman Survey, Abstract 185. This test is to be drilled to 10,500 ft.

PERMIAN BASIN

Deep-Pay Zone Proved by Andrews County Wildcat

MIDLAND.—A new deep-pay zone yielding heavy flush production was definitely proved last week in northwestern Andrews County by Mid-Continent Petroleum Corp. 1-7 University, wildcat about 2 miles south of the Fullerton field, bottomed at 8,957 ft. Operators drilled out cement in the casing to 8,750 ft., then perforated the oil string at 8,460-8,600 ft. and washed with 1,000 gal. of acid. The well started cleaning itself after five runs of the swab, then flowed into pits for an hour, when the oil was turned into tanks. During the second hour it flowed 135 bbl. of fluid, and during the third it produced 150 bbl. of 40-gravity oil, cut 4.4 per cent with mud and acid residue, no formation water, through ¾-in. choke, and gas-oil ratio of 500.

This wildcat was hailed as an important discovery several weeks ago when a drill-stem test of the same section indicated commercial production from the new pay zone, which some geologists thought was the Wolfcamp, or basal Permian. Now it is believed to be either the Silurian or the Devonian lime. Regardless of its precise geological age, it unfolds great production possibilities, being approximately 1,500 ft. deeper than the main producing zone in the Fullerton field, under which the new pay may extend.

Discovery of this pay in a zone between the two primary objectives of the well—the Permian Clear Fork and the Ordovician—emphasizes the growing importance in the West Texas district of production being found in the section between the Permian and the Ordovician beds. It presages development of important production from pay zones which several years ago appeared to offer no commercial possibilities.

Winkler County.—Sun Oil Co. 2 Keystone Cattle Co., wildcat 2 miles northwest of the Keystone-Ellenburger field, apparently will make a producer from the Silurian lime. On two drill-stem tests, the first at 8,566-83 ft. and the second at 8,583-8,623 ft., it recovered good shows of gas and oil. This well, on top of the Devonian, was checking 700 ft. lower than the Keystone-Ellenburger discovery producer. Gulf Oil Corp. 46-E Keystone was running tubing to complete at total depth of 10,005 ft. It logged 740 ft. of Ellenburger section, carrying gas and distillate in the top 286 ft., the remainder carrying oil. It is 1½ miles southwest of deep produc-

(Continued on page 142)

DAILY AVERAGE PRODUCTION FOR WEEK

	Aug. 12 crude oil	Distillate, allied products	August PAW quota all oils	Aug. 5 crude oil
Arkansas	81,000	4,500	82,500	80,600
California	852,750	51,100	917,100	849,650
Colorado	8,150	.....	7,900	8,650
Eastern	67,100	6,100	77,500	62,500
Illinois	209,700	11,500	226,500	206,500
Indiana	12,950	.....	14,000	12,900
Kansas	277,100	4,300	278,300	240,400
Kentucky	25,700	2,500	25,500	25,100
Louisiana	362,750	35,000	385,000	362,650
North Louisiana	73,800	.....	.....	73,700
South Louisiana	288,950	.....	.....	288,950
Michigan	49,400	400	51,400	47,700
Mississippi	45,450	.....	40,000	47,100
Montana	23,100	200	24,200	23,100
Nebraska	900	.....	1,000	900
New Mexico	108,400	5,500	115,500	108,300
Oklahoma	339,600	27,000	359,000	339,100
Texas	2,108,600	138,000	2,237,000	2,108,600
East Texas	371,700	.....	.....	371,700
East Central Texas	147,650	.....	.....	147,650
North Central Texas	148,750	.....	.....	148,750
Texas Panhandle	98,700	.....	.....	98,700
West Texas	484,950	.....	.....	484,950
South Central (San Antonio)	19,300	.....	.....	19,300
South Texas (Laredo)	77,400	.....	.....	77,400
Lower Gulf Coast	224,950	.....	.....	224,950
Upper Gulf Coast	535,200	.....	.....	535,200
Wyoming	83,450	3,000	103,000	92,650
Total United States	4,656,100	289,100	4,945,400	4,616,400
Total production January 1-August 12, 1944				1,007,993,450 bbl.
Same period last year				887,173,800 bbl.

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KUA, 4¼x5, 4 cyl. MEU, 8x9, 4 cyl.
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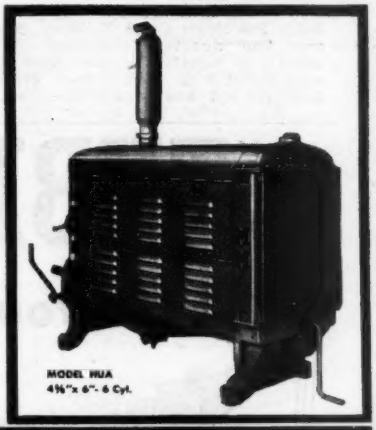

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MM TWIN CITY OIL FIELD ENGINES

HOW AMERICAN INDUSTRY PRODUCES MORE, FASTER, BETTER — WITH BOWSER EXACT LIQUID CONTROL

Here's a Bowser Liquid Control Installation that
PAYS 100% DIVIDENDS ANNUALLY

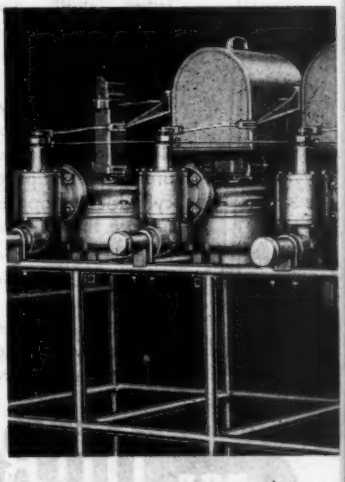
A nationally known plant in New York State installed a Bowser 2-meter Soluble Oil Proportioner for grinding and cutting solutions used in seven different departments. Previously the solutions were mixed in open drums and distributed manually.

Results... 1. Three laborers, one for each shift, were released for other work. Annual saving—$9,360.00. 2. Soluble oil consumption was reduced 10%. Annual saving—$900.00. 3. Space for two storage drums was saved in each of seven departments. The proportioner and tanks in the oil house take only 30 square feet.

The first year's savings on labor and oil far more than paid for the entire installation. After that, it's "velvet."

There's a lot of "velvet," too, in using Bowser equipment in oil production. It's a demonstrable fact that, from the standpoints of economy and production, every oil well in America, except possibly some small single wells, should have Bowser Bassler Meter installations. In a Pacific Coast field, 25 Bowser Bassler meters were installed with a net saving of capital expenditure estimated at $64,000. Further, there is considerable saving by concentrating at a central point both wet and dry oil, thereby eliminating the duplication of lines, etc.

Write for information. A Bowser engineer will consult with you if you wish. BOWSER, INC., Fort Wayne 5, Indiana.



BUY WAR BONDS

BOWSER ESTABLISHED 1885

The Name That Means Exact Control of Liquids

Not only has Bowser's war production earned the Army-Navy E... Bowser equipment has helped earn it for scores of other companies.

EASTERN TEXAS

One Wildcat and Six Field Locations Are Staked

DALLAS.—One wildcat and six field locations were staked in East Texas last week. Lasco, Inc. will drill 1 R. S. LeSage, a projected 4,000-ft. wildcat about 3½ miles northeast of Pluto, in Ellis County, 555 ft. from the northwest and 3,372 ft. from the southwest lines of E. D. Harrison Survey.

Bowie County.—Barnsdall Oil Co. and Sohio Petroleum Co. 2 Heilbron, Smackover lime discovery southwest of Texarkana, is reported to have been deepened about 5 ft. from former depth of 7,716 ft. and was setting liner to perforate and test again, with the intention of trying to cut down gas volume.

Red River County.—The Texas Co. 1 Solomon, 8 miles southeast of Clarksville, in the W. E. Edwards Survey, was drilling past 5,305 ft. in hard sand and shale. Oscar Donnelly 1 Mitchell, 2 miles south of Allen Mills, was drilling below 1,936 ft. in sand and shale.

Titus County.—Humble 1 Searcy, north of Mount Pleasant, was drilling at 7,853 ft. in sandy shale. The same company's 1 Stevens, east of Mount Pleasant, was drilling below 7,870 ft.

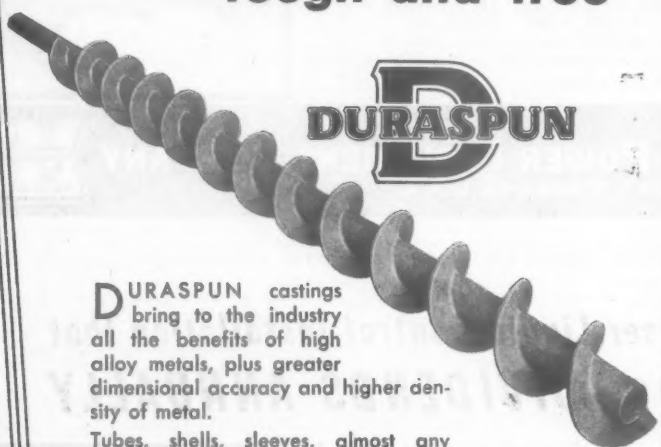
EAST TEXAS WILDCAT COMPLETIONS

Navarro County: British-American 1-A Bradley-Clarkson, Robertson CSL, 3 mi. SW Chatfield, dry, TD 2,668 ft., elev. 410 ft., Austin chalk 1,270-1,730 ft., Woodbine 2,173 ft.

Smith County: Phillips Petroleum 1 Mrs. W. J. McMinn, 660 ft. S of N, 660 ft. from E, 180.58-ac. tract, Mary M. Long Sur., A-562, Pecan Gap 3,617 ft., Austin 4,696 ft., Woodbine 5,150 ft., Comanchean 5,956 ft., Buda 6,063 ft., Mainstreet 6,436 ft., Fort Worth 6,745 ft., Duck Creek 7,058 ft., Goodland 7,239 ft., Paluxy 7,424 ft., Glen Rose 7,755 ft., anhydrite 8,532 ft., massive anhydrite 9,240 ft., top good porosity 9,864 ft., flowed 265.27 bbl. day through 10/64-in. tubing choke, TP 4,600 lb., gas-oil ratio 6,980 to 1, TD 10,017 ft.

TUBES...

tough and true



DURASPUN castings bring to the industry all the benefits of high alloy metals, plus greater dimensional accuracy and higher density of metal.

Tubes, shells, sleeves, almost any cylindrical shape, when DURASPUN, have a uniformity of wall section and freedom from casting imperfections seldom obtainable from static castings.

While concentricity is characteristic of most DURASPUN castings, out-of-round castings, with irregular exteriors—fins, grooves, lands, and other protuberances—are frequently produced centrifugally. An approximate cylindrical shape and a hole running through the center are the only two "musts" for this method.

DURALOY was one of the first foundries to offer centrifugal castings. Added to this was the prior experience of pioneering in the high alloy castings. Today, DURALOY has men and facilities to turn out the *best* high alloy castings, static or centrifugal, weighing from a pound or two to 8000 pounds.

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SOUTHWEST TEXAS

Edwards Lime Producer Completed in Atascosa

CORPUS CHRISTI.—A new Edwards lime field has been opened in the western part of Atascosa County by Humble Oil & Refining Co. 3 E. J. Pruitt et ux. The well is on a 2,000-acre lease in Section 53, Antonio Estrada Survey, Abstract 224. On a 4-hour test the well flowed at the daily rate of 187.50 bbl. through a 3/16-in. choke, gas-oil ratio 1020, tubing pressure 700 lb. Casing was sealed but the packer failed to hold, and casing pressure built up to 300 lb. Gravity is 37.7°, corrected. The hole was drilled to a total depth of 6,923 ft. with Edwards lime topped at 6,869 ft., and 5½-in. casing was set for completion.

About 2 miles northwest of Pettus, in Bee County, Navarro Oil Co. completed 1 E. J. Spielhagen, wildcat in the John Page Survey, as a gas well and is shut in. This test was drilled to a total depth of 7,432 ft., and completion was made in perforations at 7,334 to 7,348 ft., where it was cleaned on ¼-in. choke, with tubing pressure 2,400 lb., casing pressure 2,450 lb., dry gas. A drill-stem test at 7,179 to 7,197 ft. showed some condensate, and a test at 7,051 to 7,069 ft. showed some oil.

The second well for the Brayton field shows an estimated 30,000,000 cu. ft. of gas daily, open, with about 20 bbl. condensate per million feet of gas. It is the H. R. Smith and W. C. McBride 2 W. H. Rivers estate. The test was through perforations at 6,592 to 6,638 ft.

Extension well in the Taft area, San Patricio County, Republic Natural Gas Co. 3 John Hancock National Life Insurance Co., in the T. T. Williamson Survey, made a potential of 155.3 bbl. net of oil daily, plus 7.7 bbl. of water through 5/16-in. choke, with tubing pressure 50 lb., gas-oil ratio 277, gravity 22.6°. Total depth is 4,935 ft., with top of pay at 4,918 ft. and perforations at 4,916 to 4,918 ft.

The name "Dan Sullivan" has been given by the Oil Field Nomenclature Committee of the South Texas Geological Society to the field discovered by Sun Oil Co. at 1 D. J. Sullivan, in El Tule (A. Garcia) Grant, in northeast corner of Brooks County.

SOUTHWEST TEXAS WILDCAT COMPLETIONS

Brooks County: Shell 1 Guaranty State Bank, 1¼ mi. NE of Kelsey field.

LEGAL

Notice of Oil & Gas lease sale: The U.S. Department of Agriculture will award leases on 15 tracts of approximately 2490 acres in Cochran County, Texas, on former Slaughter Ranch. Rent $1.00 per acre Awards limited to 1 tract per lessee. Sealed bids to be publicly opened September 15. Bid forms and additional information can be secured from Ray E. Davis, Acting Regional Director, Farm Security Administration, Old Post Office Building, Amarillo, Texas. Permission may be obtained from Mr. Davis for making preliminary geophysical and geological surveys upon written request.

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On gas service where pressure and temperature conditions are high, Armstrong Traps with parts designed for pressures as high as 1500 lbs. and temperatures of 750° give a lifetime of service with little or no maintenance.

The special high quality material, precision workmanship, and simple design keep Armstrong Traps operating under all conditions.

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Air Traps
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Gas Pipe Lines
Drilling Rigs

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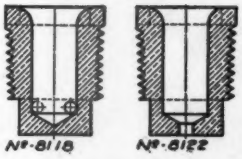
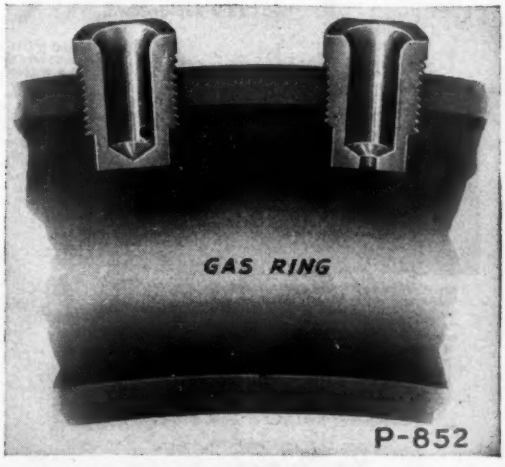
provide many operating advantages

The National Airoil patented* design Gas Tip is a decided improvement over the conventional type gas tip for cylindrical, ring gas burners, as well as pipe gas burners.

This gas tip, as can be seen in the illustration, has the orifice immersed in the gas chamber so that the orifice is protected from overheating, oxidizing and coking by the cooler gas in the ring. Also, the gas orifice being located in the cup, is screened from most of the radiant heat of the furnace. Because of these features, the gas tips are practically free from clogging or deterioration, even after a long period of continuous operation.



*U.S. Patent #2,160,615



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GC&SF Survey 721, Abstract 289, dry at 6,477 ft.

Duval County: J. W. Gorman 2 A. Herbst, H&GN Survey, 9, 9 mi. E of Freer, dry at 2,980 ft.

Gonzales County: W. V. Hardin 1 S. T. Robinson, John T. Smith Survey, 2½ mi. S of Jeddo, dry at 4,005 ft.

Guadalupe County: Wieband Bros. 1 Paul and Emma Baumert, Matthew BeSore Survey, 2 mi. S of Kingsbury, dry at 2,562 ft.

Jim Hogg County: Sinclair Prairie 1 Aurora G. Gallagher, Neuhaus area, 1½ mi. SE of Neuhaus field, Rafael de la Pena "Moritas" Survey, Abstract 245, dry at 3,799 ft.

Nueces County: Stanolind 1 C. W. Kerr, 2 mi. E of Riverside field, J. L. De Herrera Grant, dry at 8,020 ft.

Starr County: Sun Oil Co. 1 Juan N. Salianas et al, SE of Yturria field, in Porcion 39, Juris. of Reynosa, dry at 4,819 ft.

Victoria County: Kingwood 1 M. F. Bass, NW Victoria townsite 4-league grant, 2 mi. S of Victoria, dry at 2,957 ft.

Webb County: Magnolia 1 O. G. Sanchez, Joaquin Galan Grant 2,292, 6½ mi. NW of Callaghan, dry at 5,001 ft.

SOUTH LOUISIANA

World's Deepest Producer Gages 648 Bbl. Daily

NEW ORLEANS.—Deepest oil producer in the world, Union Producing Co. and Fohs Oil Co. 2 Buckley-Bourge, De-Large field, Terrebonne Parish, which has been standing for months waiting on equipment, has been gaged. It showed a daily potential of 648 bbl. on 10/64-in. choke, based on a 2-hour gage, with gas-oil ratio 2,100, tubing pressure 2,300 lb., casing sealed, gravity about 36°, no water. Total depth of the hole is 13,588 ft. and production is from perforations at 13,498 to 13,503 ft. These perforations are slightly below the level from which the same operators' 1 Fitzpatrick-Vizard, same area, is producing.

Amerada Petroleum Corp. 1 Glassell et al, wildcat in 16-12s-10w, north of the West Hackberry field in Cameron Parish, was abandoned at total depth of 9,634 ft., after running log and taking sidewall samples.

Claude Morgan et al 1 Irene Wettermark, new wildcat, in 24-5n-3w, is reported to have spudded. Contract depth is 6,500 ft. Stanolind Oil & Gas Co., Bob Farrish and Edwin Nielson are reported supporting the test. Royalty is said to have been sold in the area for as high as $50 an acre.

A new location for the North Richie area of Acadia Parish has been made by Continental Oil Co. 2 Paul Daigle. A one-rig drilling campaign has been carried on by Continental in this area, Nicklos Drilling Co. being the contractor. This test is scheduled to be drilled to 8,650 ft.

SOUTH LOUISIANA WILDCAT COMPLETIONS

Cameron Parish: Amerada 1 Glassell et al, N of West Hackberry field, 16-12s-10w, dry at 9,634 ft.

East Baton Rouge Parish: Robert Walker 1 Repollo Community, McInnis area, 54-7s-1e, dry at 10,012 ft.

More work... lower cost

THANKS TO LA PLANT-CHOATE "KNOW HOW"

One of the main reasons for the world-wide popularity of LaPlant-Choate dozers is their proved ability to do a *better job at lower net cost.* In other words, when you buy a LaPlant-Choate dozer, you get more than just a blade in front of a tractor. You get an "engineered unit" developed and improved through *21 years of field experience* with thousands of LaPlant-Choate dozers in all parts of the world. Moreover, as one of America's largest suppliers of dozers to the armed forces, LaPlant-Choate is gaining additional experience that assures you of *even better performance* from LaPlant-Choate dozers in the future. So before you buy any new dozer equipment, be sure to get complete facts on LaPlant-Choate's new, improved line—with *either cable or hydraulic control.* LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa.

DID YOU KNOW that the first LaPlant-Choate bulldozers were built for Best and Holt tractors long before the days of "Caterpillar" . . . that LaPlant-Choate pioneered the first production dozer with hydraulic control (1925) . . . a dozer with an angling blade (1927) . . . a tilting blade (1929)? Did you know that LaPlant-Choate engineers developed the first lightweight dozers and scrapers to be flown in transport planes (1942)? . . . and the first dozers to be used successfully with Army tanks (1943)? Did you know that last year, according to official WPB figures, LaPlant-Choate built over 33⅓% of all the dozers produced in the United States by 18 different companies . . . and that LaPlant-Choate now controls over 15 patents covering basic improvements in dozer design?

Above: This crude, hand-operated LaPlant-Choate dozer was developed in 1923 for use on the famous Dixie Highway in Kentucky. Modern hydraulic and cable operated models offer numerous improvements in blade design, operating features and all around dependability.

LaPLANT-CHOATE

Earthmoving and Land Clearing Equipment

MICHIGAN

Sohio Opening New Pool In Isabella County

SAGINAW.—Prospects of a new pool in Isabella County, new wildcat producers in Allegan and Montcalm counties and the reentry of Shell Oil Co. into the exploration picture featured developments in Michigan fields this week.

Sohio Petroleum Co. 1 Cummings, N/2 NW NW 33-16n-6w, Coldwater Township, Isabella County, on test, flowed 37 bbl. from the Dundee at 3,695 ft., after which the well was shut in to await storage facilities. The potential new pool opener is 6 miles north of the Sherman-Broomfield pool and about the same distance southeast of Mecosta County's Fork pool.

The Allegan County wildcat, Alan W. Winchester's 1 Fleecer, N/2 NE NW 27-3n-13w, pumped 28 bbl. in 7 hours from the Traverse at 1,624 ft., after being acidized. In Montcalm County, H. L. Wadsworth 1 Peters, NW SW SW 32-9n-5w, Bloomer Township, flowed 100 bbl. natural from the Traverse at 2,660 ft.

Shell Oil Co., resuming drilling operations in Michigan, after a lapse of several years, has imported a rig and crew from Pratt, Kansas, for a test well in Section 16, Novesta Township, Tuscola County, and has engaged in exploration work along Saginaw Bay shore in Bay County, near where Gulf Refining Co.'s third producer has just been completed. Gulf 1 Walther, NE SW NE 7-14n-6e, Hampton Township, flowed 250 bbl. per day from the Dundee at 2,885 ft.

In Arenac County, M. E. Holloway's 1 Koscot, NE NW NW 16-19n-4e, extended the Deep River pool a half mile and will probably inspire considerable additional drilling. Don Rayburn's 1 Trumble, NW NW NW 5-19n-3e, in Adams Township, found the Dundee dry at 3,062 ft.

MICHIGAN WILDCAT COMPLETIONS

Allegan County, Hopkins Township: Oil Producers, Inc. 1 Pegg, NE SE SE 16-3n-12w, dry in Traverse limestone, TD 1,747 ft.

Martin Township: James J. McGerry, Tr., 1 Monteith, SW SW SE 29-2n-11w, dry in Monroe, TD 1,870 ft.

Monterey Township: Alan W. Winchester 1 Fleecer, N½ NE NW 27-3n-13w, pumping 28 bbl. with salt water, acidized, TD 1,624 ft. in Traverse limestone.

Aremac County, Adams Township: Don Rayburn 1 Trumble, NW NW NW 5-1-9n-3e, dry in Dundee, TD 3,062 ft.

Gratiot County, North Star Township: C. E. Weller-Kapral-Iler, NE NE NE 7-10n-2w, dry in Dundee, TD 3,207 ft.

Montcalm County, Bloomer Township: H. L. Wadsworth 1 Peters, NW SW SW 32-9n-5w, 100 bbl. natural in Traverse limestone, TD 2,660 ft.

Osceola County, Sherman Township: Gordon Oil 1 Culver, S½ SE SW 9-20n-9w, dry in Monroe, TD 4,054 ft.

Roscommon County, Baskins Township: Sun Oil C-1 St. Helen Resort Association, N½ NE NE 34-22n-2w, dry, TD 5,023 ft.

ILLINOIS

Patton West Pool Gets Extension

CENTRALIA.—Fifty-four wells were reported completed in Illinois in the past week, of which 10 were wildcats. One of the latter named was a producing well which extends the Patton West pool in Wabash County. Thirty-one of the completed wells were oil producers, with a combined initial output of 3,424 bbl., an average of 110 bbl. per well.

Ben H. Nations completed the best well of the week in 1 J. L. Pollard, NE NW NE 28-3s-9e, in the Burnt Prairie pool in White County. It started off flowing 1,232 bbl. naturally in 48 hours from Aux Vases sand at 3,238-72 ft.

Fifty new operations were reported, including the following 11 wildcats: George & Wrather 1, W½ NW SE 25-5n-13w, and Ralph Willis et al 1 R. Fitzpatrick, SW SW NE 10-6n-11w, Crawford County; Magnolia Petroleum Co. 1 M. A. Rinnert, NE NE NE 33-4n-8e, and Amsco 1 T. McAllister, SE SW NW 3-2n-7e, Clay County; Phillips Petroleum Co. 1 B. K. Leach, SE SE NE 12-4s-6e, Hamilton County; Cockran & Hutchins 1 Brad Powell, SE NE NW 36-6s-8e, White County; Shell Oil Corp. 1 E. E. Davis, NW NE NE 23-4s-3e, Jefferson County; F. E. Webb 1 Manley, E½ NE SW 10-4n-1w, Bond County; Central Pipe Line Co. 1 B. Sowers, SW SW NW 7-8n-9e, and Ohio Oil Co. 1 Ben Burton, NW SW NE 24-7n-9e, Jasper County; St. Clair Oil Development Co. 1 Holliday, SW SW SW 30-2n-7w, St. Clair County.

ILLINOIS WILDCAT COMPLETIONS

Cumberland County: C. E. Green 1 Hayworth Bros., SE SE SW 14-10n-10e, dry at 830 ft.

Fayette County: Magnolia 1 L. Carson, NE SE NE 8-8n-2e, dry at 2,032 ft., Glen Dean 1,519 ft., Benoist 1,846 ft., Ste. Genevieve 1,925 ft.

Gallatin County: Ryan Oil 1 Glover-Mills, NE SE SW 21-7s-9e, dry at 3,087 ft., Palestine 2,045 ft., Cypress 2,607 ft., Benoist 2,813 ft., Aux Vases 2,905 ft., Ste. Genevieve 2,976 ft., St. Louis 3,072 ft.

Jasper County: W. R. Gross 1 Danly, NW NW NE 24-5n-10e, dry at 3,039 ft., Palestine 2,160 ft., Glen Dean 2,396 ft., Cypress 2,580 ft., Benoist 2,805 ft., Aux Vases 2,882 ft., Ste. Genevieve 2,915 ft.

Richland County: L. B. Jackson 1 R. W. McDonald, SW SW SW 14-2n-10e, dry at 3,366 ft., Menard 2,419 ft., Cypress 2,907 ft., Benoist "shaly," Aux Vases 3,190 ft., McClosky 3,295 ft.

Cardwell 1 B. M. Miller, NW SE SW 2-3n-9e, dry at 3,025 ft., Tar Springs 2,310 ft., Cypress 2,601 ft., Ste. Genevieve 2,924 ft., Fredonia 2,951 ft.

St. Clair County: Skelly Oil 1 H. Schieckedanz, NE SE NW 12-3s-6w, dry at 2,805 ft., Glen Dean 544 ft., Cypress 750 ft., Benoist 856 ft., Aux Vases 983 ft., Ste. Genevieve 1,010 ft., Osage 1,575 ft., Devonian 2,036 ft., Silurian 2,176 ft., Trenton 2,684 ft., Decorah 2,789 ft.

Wabash County: Shell 1 H. Dunkel, SW NW SW 33-1n-12w, pay in Weiler sand shot with 16 qt., pumped 35 bbl. of oil and 14 bbl. of water initially, TD 2,435 ft. Extends the West Patton pool southerly.

Washington County: R. L. Rea 1 Banozek, SE NW NE 27-3s-2w, dry at 1,300 ft., lower Menard 785 ft., Cypress 1,119 ft., Benoist sand 1,267-76 ft. and 1,290-96 ft.

Smokey Oil 1 McWilliams, NW NW SE 28-2s-2w, dry at 1,836 ft., Glen Dean 1,134 ft., Cypress 1,324 ft., Benoist 1,511 ft., Aux Vases 1,571 ft., Rosiclare 1,707 ft.

CANADIAN FIELDS

Vermilion Field in Alberta Extended to Northeast

CHATHAM.—The Vermilion field, eastern Alberta, has been extended to the northeast by completion of Saskahead 1, LSD 7, 32-50-5w4, as a producer.

In the Conrad field, southern Alberta, California-Standard 2, LSD 1, 5-6-15w4,

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plugged back to 2,963 ft., is making 140 bbl. daily of 25-gravity crude. California-Standard 35 has location in LSD 11, 5-6-15w4.

Pinhorn dome.—On the Pinhorn dome, near the Montana boundary, McColl-Frontenac 2, LSD 9, 17-1-8w4, bottoming at 3,328 ft., gun-perforated at 3,314-17 and 3,304-07 ft. with some gas in the upper and traces of oil with water in the lower horizon. It has been abandoned.

APPALACHIAN FIELD

Oriskany Test Is Started In Pocahontas County

PITTSBURGH.—An Oriskany test is starting near the Appalachian frontier in Pocahontas County, West Virginia, where Ohio Oil Co. has made a location on West Virginia Seneca State Park, on Michael Mountain, in the Huntersville district.

In Boone County, West Virginia, the Owens Libby Owens Gas Department drilled to 5,595 ft. in 675 Allen & Pryor in Scott district, or through the Red Medina, with no commercial gas showing in the Silurian or lower Devonian. The test is being plugged back to shoot the Brown shale.

In German Township, Fayette County, Pennsylvania, Orville Eberly et al had a shallow strike in a test on the A. L. Sharpnack farm, where at 854 ft., Cannel Coal, there was a gage of 900,000 cu. ft. of gas, open flow, which when turned in the lines for test delivered about 500,000 cu. ft. with evidence of water intruding.

ROCKY MOUNTAIN

Frontier's White River Test Finished as Small Gasser

DENVER.—The Frontier Refining Co. has completed its deep test in the White River field, Rio Blanco County, Colorado, as a small gas well in sands of the Mesa Verde formation for an undetermined flow of gas pending a regaging. The well, on federal land, in CSL NW NW 32-2n-96w, topped the Mesa Verde at 5,560 ft. and cut numerous sands in that formation down to a total depth of 7,005 ft. It then plugged back and tested a series of sands at 5,558-5,976 ft., which showed about 25 bbl. per day of high-gravity crude, which is noncommercial at that depth. It then plugged back to 5,928 ft. and was completed as a gas well.

Carter dry hole at Gage.—The Carter Oil Co., which turned most of its acreage on the Gage dome in Musselshell County, Montana, over to Northern Ordnance, Inc., following completion of the discovery well by the latter late last year, retaining an overriding royalty, has completed as a dry hole a test drilled on its own account. This well, 1 State, NW SE 19-9n-26e, ½ mile northwest of the discovery, was completed at 5,986 ft. It had the top of the Amsden at 5,961 ft. with some shows of dead oil, but no live shows. On a drill-stem test it flowed 20 bbl. of water per minute. Northern Ordnance has some 15 operations on the structure, including drilling wells. Three were dry and abandoned. Seven have suspended operations and rigs were moved off after reaching the Amsden. Four, including the discovery (rated at 25 bbl. per day) are listed as producers. One well, 3 Darr, east of the discovery, was reported flowing 471 bbl. in 24 hours.

(Continued on page 142)

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C., Notice is hereby given that the W½NE¼ and SE¼NW¼ sec. 13, T. 18 S., R. 27 E., 120 acres, Artesia field, New Mexico, is offered to the qualified bidder of the highest cash amount offered per acre as a bonus for the privilege of leasing the land under section 17 of the mineral leasing act, as amended by the Act of August 21, 1935 (49 Stat. 674, 30 U. S. C sec. 226). The land will be offered as a single unit. Sealed bids will be received in the office of the Secretary of the Interior, Interior Department Building Washington 25, D. C., up to 12 noon, September 6, 1944. Each bidder must submit a certified check or cash for one-fifth of the amount bid payable to the order of the Treasurer of the United States and file the showing of qualifications to receive the lease required by section 8 of Circular 1386. The remainder of the bonus bid and the annual rental at the rate of $1 per acre must be paid and a $5,000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the other bidders will be returned. The envelopes should be plainly marked, "Bid for lease in Artesia field. Not to be opened before noon, September 6, 1944." No bids received after the time fixed herein for submitting bids will be considered. The successful bidder will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

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KEEPS DRILLING MUD CLEAN — PROVIDES TRUE SAMPLES OF CUTTINGS

OHIO, KENTUCKY

E. Zanesville Gas Pool Extended ½ Mile North

COLUMBUS.—The East Zanesville gas pool was extended one-half mile to the north by E. O. White 1 Bonifield-Walker, 4th Qr.—S, Washington Township, Muskingum County. Sand was found at 3,883-3,914 ft. with an open flow of 5,235,000 cu. ft.

The completion of a 4,750,000-cu. ft. wildcat by H. K. Porter opens up an attractive area between the Brush Creek and Crookville fields. The well, on H. D. Pletcher S.W.N.E. Section 30, reached the top of the Clinton at 4,031 ft., and drilling was stopped at 4,053 ft., still in sand, with a rock pressure of 1,250 lb.

Portage Producers extended the Black-Fork pool a location to the northeast by an 848,000-cu. ft well, 26 Cambria Clay Prod., Sec. 7, Greenfield Township, Gallia County. Production is trending to the northeast and a location further in that direction will be staked.

OHIO WILDCAT COMPLETIONS

Coshocton County, Jefferson Township: Pure Oil 1 C. P. Foster, Lot 14, Clinton 3,145-3,198 ft., Medina 3,216-3,230 ft., dry, TD 3,246 ft.

Morgan County, York Township: H. K. Porter 1-C H. P. Pletcher, Sec. 30, Clinton 4,031-4,053 ft., SIS 4,750,000 cu. ft., TD 4,053 ft.

WESTERN KENTUCKY

OWENSBORO, Ky.—Eight oil wells were reported completed during the week in Western Kentucky, together with 11 dry holes. The oil wells averaged 141 bbl. per well initially.

A wildcat near Clay, Webster County, Carl Seneff 1 Clark heirs and Mitchell, swabbed 7 bbl. per hour while cleaning out following an 80-qt. shot in Penn sand at 1,004-26 ft.

WESTERN KENTUCKY WILDCAT COMPLETIONS

Daviess County: Sun Oil 1 Clarence Hancock, NE 20-O-27, dry at 2,115 ft., Vienna 1,303 ft., Glen Dean 1,478 ft., Jackson sand 1,680 ft., Cypress 1,735 ft., Bethel 1,882 ft., Ste. Genevieve 2,005 ft.

J. C. Ellis 1 R. L. O'Brien, C S½ 11-O-27, dry at 2,102 ft.

Henderson County: Gulf 1 Martin heirs, SE SE NW 14-Q-20, dry at 2,756 ft., Aux Vases 2,563 ft., McClosky 2,624 ft., St. Louis 2,742 ft.

Carter Oil 1 E. F. Denton, NW NW NW 3-N-23, dry at 2,695 ft.

C. Wood 4 Clore, 16-Q-22, dry at 2,328 ft.

Webster County: Joe Bander 1 Carl Majors estate, C NW 5-L-25, near Slaughters, dry at 3,098 ft., lower Kincaid 1,994 ft., Barlow 2,693 ft., Renault 2,816 ft., Ste. Genevieve 2,918 ft., McClosky 3,080 ft.

Union County: Ashland 1 G. F. Clements, 1 mi. NE of Uniontown, dry at 2,543 ft., Vienna 2,807 ft., Barlow 2,185 ft., Ste. Genevieve 2,458 ft., McClosky 2,524 ft.

INDIANA

EVANSVILLE, Ind.—Ashland Oil & Refining Co. and H. E. Ledbetter 2 Joe W. Mann, C W½ NE NW 5-7s-14w, in Posey County, was showing as the best well in the area, having flowed at the rate of 200 bbl. per day from Waltersburg sand at 2,096-2,110 ft. It was shut in until tankage could be provided. Three oil wells and 5 dry holes were included in the list of the week's completions in Indiana.

INDIANA WILDCAT COMPLETION

Gibson County: Chester Oil 1 Mattie Dillon, SW SW NW 16-1s-9w, dry at 1,500 ft., Glen Dean 1,282 ft., Golconda 1,394 ft.

KANSAS

10 New Wildcat Starts By Kansas Operators

THERE were 35 new operations started this week compared to 22 completions, including 10 new wildcat locations compared to 5 wildcat completions. The new wildcat starts were in Barber, Barton, Brown, Gove, Graham, Meade, Reno, Saline, Wichita and Woodson counties.

In the list of 22 completions, there were 10 oil wells, 2 gas wells and 10 dry holes, 5 of the dry holes being wildcat completions. The oil producers were mostly small, but in Graham County, Shell Oil Co., Inc., 3 Knipp, NW SE SW 14-9-21w, Morel pool, drew top potential rating of 3,000 bbl. from Arbuckle pay at 3,739-43 ft. Atlantic Refining Co. 2 Neill, NW SW NE 27-24-14w, Richland pool in Stafford County, had a potential rating of 806 bbl. from Arbuckle pay at 4,200-09 ft., the only other completion of the week to rate better than 500 bbl.

KANSAS WILDCAT COMPLETIONS

Barber County: Ohio Oil et al 1 Shriver, SE SE SE 5-30-14w, dry, TD 4,752 ft., Arbuckle 4,657 ft.

Ellis County: Bridgeport 1 Strecklein "A," SE SE NE 13-14-18w, dry, TD 3,594 ft., Arbuckle 3,557 ft.

Ellsworth County: Texas 1 Sauberli, NW NW NW 19-17-8w, dry, TD 3,282 ft., Arbuckle 3,258 ft.

Graham County: Vickers 1 Kansas Farm Corp., SE SE SW 20-8-21w, dry, TD 3,758 ft., Arbuckle 3,728 ft.

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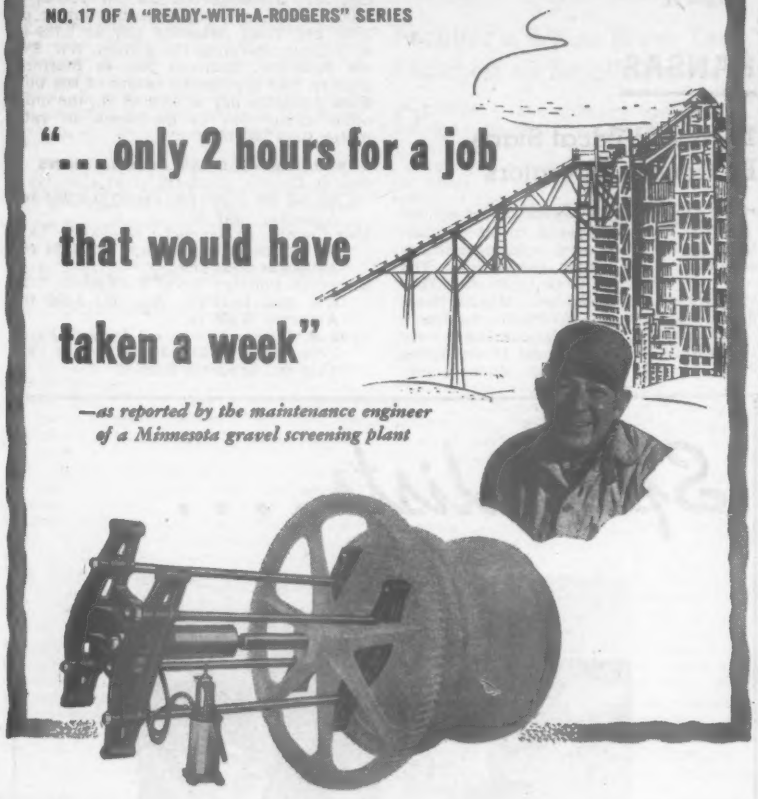

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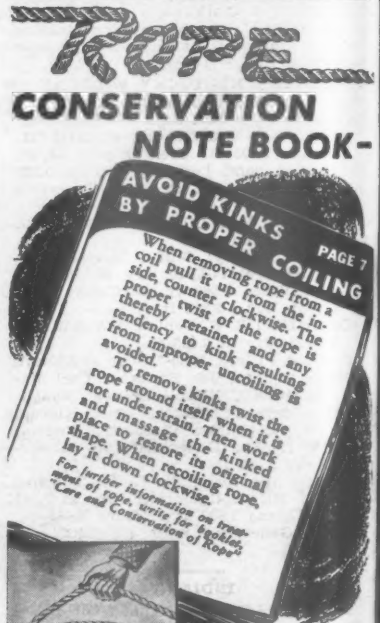
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PAGE 7
When removing rope from a coil pull it up from the inside, counter clockwise. The proper twist of the rope is thereby retained and any tendency to kink resulting from improper uncoiling is avoided.
To remove kinks twist the rope around itself when it is not under strain. Then work and massage the kinked place to restore its original shape. When recoiling rope, lay it down clockwise.
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233 BROADWAY • NEW YORK, N. Y.
Mills: New Bedford, Massachusetts

Russell County: Lauck & Moncrief 1 Hendrick, SE SE NE 2-15-13w, dry, TD 3,333 ft., Arbuckle 3,305 ft.

FOREST CITY BASIN

ST. JOSEPH, Mo.—Cities Service Oil Co. 3 Cook, SW NE NW 32-65n-39w, in the Tarkio, Mo., oil pool, was showing water at 1,451 ft. The company's 4 Cook, in SW NW NW of the same section, was drilling at 950 ft.

McLaughlin et al 1 Murphy, SW NE 9-10s-21e, Leavenworth County, Kansas, in the McLouth pool, was a dry hole in the Mississippi lime, topped at 1,281 ft. and drilled to 1,283 ft.

J. M. Huber 1 Community, NW NW NW 33-12s-11e, Wabaunsee County, Kansas, topped Mississippi lime at 1,069 ft. and was drilling at 1,119 ft.

N. CENTRAL TEXAS

New Pool Foreshadowed In Montague County

WICHITA FALLS.—A pool opener 10 miles northeast of Nocona, in Montague County, is possible at Glenn Grimes and Joe Schmitt 1 W. S. Barcus, in the northwest corner of Block 78, Kaufman CSL. Operator has cemented 5½-in. casing at 3,964 ft. to make a production test of broken sand carrying shows of oil and gas at 3,961-4,160 ft. Total depth of the hole is 4,480 ft., in granite topped at 4,478 ft.

Last week's summary showed 37 new locations in the North Texas area, of which 8 were wildcats. Twenty-one of the locations were for tests to be drilled to depths of less than 2,000 ft.

King County.—Shamrock Oil & Gas Co. and Roeser & Pendleton, Inc. 1 Masterson, wildcat in the J. R. Johnson Survey, drilled soft lime at 5,244-46 ft. and went in to core ahead. In the same county, Gulf Oil Corp. 1 Masterson, 15 miles northeast of Guthrie, showed salt water on a drill-stem test at 6,515 ft. and was drilling ahead past 6,595 ft.

Foard County.—The Texas Co. staked 1 T. N. Bell as a 6,000-ft. wildcat 3 miles southeast of Crowell, in the southeastern part of the A. Luce Survey.

NORTH TEXAS WILDCAT COMPLETIONS

Cooke County: Tom L. Sessions et al 1 A. Hellman, Thos. Toby Sur. A-1,060, 6 mi. S Muenster, dry, TD 2,880 ft.

Fred Snugs et al 1 J. L. Newman heirs, C. Collingsworth Sur., A-211, 1 mi. W Woodbine, dry, TD 4,729 ft., elev. 749 ft., Ellenburger 4,702 ft.

Trumter Petroleum 1 Paul Yarbrough, Thomas Cook Sur. A-258, 1 mi. NE Era, dry, TD 1,768 ft., elev. 974 ft., Ellenburger 1,450 ft.

Denton County: Stanolind 1 G. C. Dunn, J. Parks Sur. A-108, 2 mi. N and 5 mi. W Bolivar, dry, TD 3,416 ft.

Jack County: Brazos River Gas Co. 1 Mrs. E. C. Hartnett, Sec. 855, TE&L Sur., 1 mi. S and 1 mi. E Finis, dry, TD 5,218 ft., elev. 1,165 ft., Chappel 4,959-5,085 ft., Ellenburger 5,085 ft.

Montague County: Continental et al 1 J. M. Hundley, D. Martindale Sur. A-465, ½ mi. S and 1 mi. W Mallard, 996 bbl. through ½-in. choke, pay zone 6,228-35 ft., TD 8,018 ft., elev. 962 ft., Caddo 6,199 ft., Marble Falls 6,434 ft., Barnett 6,590 ft., Simpson dolomite 7,751 ft., Ellenburger 7,930 ft.

Sinclair Prairie 1 J. W. Bass, Titus CSL, 6 mi. E Bowie, dry, TD 6,355 ft., Caddo 6,026 ft., Barnett 6,337 ft.

Young County: Kerlyn & Phillips Petroleum 1 W. H. Clarida, W. A. Nicholson Sur. A-1692, ½ mi. S Farmer, TD 5,910 ft., plugged back to 5,356 ft., acidized total 2,500 gal., IP 816 bbl. day, gas-oil ratio 670 to 1.

Northern Ordnance 1 F. H. Robertson, F. L. Green Sur., A-105, 5 mi. W and 1½ mi. N Eliasville, TD 4,676 ft., elev. 1,194 ft., Caddo 3,443 ft., Barnett 4,473 ft., Mississippian 4,572 ft., Ellenburger 4,660 ft.

Standard Oil of Ohio 1 J. R. Garvey, Sec. 1856, TE&L Sur., 4 mi. N Farmer, acidied 1,000 gal. mud acid, IP 1,342 bbl. day, TD 4,480 ft., elev. 1,179 ft., Caddo 4,463 ft.

WEST CENTRAL TEXAS

ABILENE.—A Caddo lime pool was opened by Humble Oil & Refining Co. 1 Green, 10 miles northwest of Breckenridge, Stephens County, 1,980 ft. from north and east lines of the James Connor Survey No. 13, A-43. It logged saturated Caddo lime from 3,576-86 ft., total depth, and after acidizing with 2,000 gal., cleaned itself through tubing and was shut in without taking final gage.

WEST CENTRAL TEXAS WILDCAT COMPLETIONS

Callahan County: Northern Ordnance 1 S. Hennessy, BS&F Sur., A-538½, 5 mi. NW Clyde dry, TD 4,940 ft., Palo Pinto 3,110 ft., Caddo 3,550 ft., Mississippian 4,810 ft., Ellenburger 4,895 ft.

LA.-ARK.

New Tuscaloosa Well For Lake St. John

SHREVEPORT.—The California Co. and Carter Oil Co. 4 State Lease, 750 ft. west and 100 ft. south of NW cor. 18-9n-10e, in the lake, at Lake St. John pool was completed for 175 bbl. from the Tuscaloosa sands at 9,018-66 ft., the best completion of the week for the North Louisiana-Arkansas area.

There were eight completions in Arkansas, including a 20-bbl. well in the Troy pool and an 81-bbl. workover in the Patton pool, a gas well in the Wisinger pool, and five dry holes, including three dry wildcats. North Louisiana had eight completions, the only oiler being the Lake St. John completion, three gas wells in the Monroe field and four dry holes in which were included three dry wildcats.

New operations started totaled five in Arkansas, including one wildcat start in Ouachita County, northwest of the Smackover field and one wildcat start in Union County, north of the New London pool. North Louisiana drew 11 new operations, including 1 wildcat start in Grant Parish and 1 in Morehouse Parish.

NORTH LOUISIANA WILDCAT COMPLETIONS

De Soto Parish: Oakes, Easton & Logan 1 Ramsey, 1,980 ft. N and 681 ft. E of SW cor. 27-13n-16w, dry, TD 3,460 ft.

Oakes, Easton & Logan 2 Ramsey, NE SE 28-13n-16w, dry, TD 5,388 ft.

Franklin Parish: C. L. Smith 1 Bates, NW NW SW 18-12n-8w, dry, TD 7,513 ft.

ARKANSAS WILDCAT COMPLETIONS

Calhoun County: Durbin Bond 1 Stout Lumber Co., SW SW SE 34-14s-14w, dry, TD 2,750 ft.

Ouachita County: Kerlyn Oil 1 Cooper, NE SE 1-11n-17w, dry, TD 2,880 ft.

Union County: Marine Oil 1 Ezzell, NE NE 13-17s-15w, dry, TD 6,260 ft.

MISSISSIPPI

JACKSON.—The center of interest this week was still S. W. Richardson 1 Berry, SE NW 24-9n-19w, the wildcat in Jeff Davis County, which had a flow of distillate and gas. The gas flow has been killed and attempts are being made to dual complete the well to produce from shows at 7,856-80 ft., and 8,076-8,106 ft. There are now 71 locations and active operations in 21 counties in the state.

Humble Oil & Refining Co. 1 Skinner, a wildcat in 10-3n-10e, Escambia County, Alabama, is coring below 9,680 ft., with no shows reported. Humble 2 Gulf Coast Realty Co., in 30-48s-30e, Collier County, Florida, is reported to have stuck drill pipe at total depth of 12,885 ft.

Active operations and locations are reported at 10 for Alabama, 5 in the Gilbertown field and 5 wildcats; 8 wildcats in Florida and 2 wildcats in Georgia.

WILDCAT COMPLETIONS AND DISCOVERIES

	Week ended August 12, 1944					Cumulative total, 1944				
	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ohio	0	0	1	1	2	0	0	11	43	54
Indiana	0	0	0	1	1	3	0	0	16	19
Illinois	1	0	0	9	10	19	0	0	202	221
Kentucky	0	0	0	7	7	6	0	0	49	55
Michigan	2	0	0	6	8	8	0	2	155	165
Kansas	0	0	0	5	5	34	0	5	259	298
Nebraska-Missouri-Iowa	0	0	0	0	0	1	0	0	9	10
Oklahoma	1	0	1	10	12	39	0	18	160	217
Texas:										
North Central	3	0	0	8	11	42	0	1	185	228
West	2	0	0	1	3	20	0	3	106	129
Panhandle	0	0	0	1	1	0	0	0	7	7
Eastern	1	0	0	1	2	5	0	1	82	88
Gulf Coast	0	0	0	3	3	24	9	11	140	184
Southwest	0	0	0	6	6	17	4	13	149	183
Total	6	0	0	20	26	108	13	29	669	819
Louisiana:										
Northern	0	0	0	3	3	3	0	0	36	39
Southern	0	0	0	2	2	5	6	0	35	46
Total Louisiana	0	0	0	5	5	8	6	0	71	85
Arkansas	0	0	0	3	3	2	1	0	34	37
Mississippi	0	0	0	0	0	2	0	0	44	46
Alabama-Georgia-Florida	0	0	0	0	0	2	0	0	12	14
Montana	1	0	0	2	3	3	0	1	22	26
Wyoming	0	0	0	1	1	10	0	1	12	23
Colorado	0	1	0	0	1	2	0	1	21	24
New Mexico	0	0	1	1	2	4	0	3	36	43
California	0	0	0	3	3	4	0	5	129	138
Total United States	11	1	3	74	89	255	20	76	1,943	2,294
Total previous week	7	0	3	86	96					

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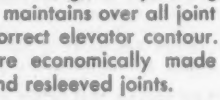

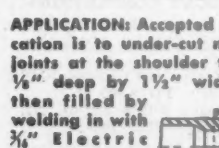

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Among the

Drilling Contractors

Herndon Drilling Co. was starting the 1 Springers, in SW NW SE 11-19s-10w, north of the Brandenstein pool, in northwestern Rice County, Kansas.

Lloyd O'Donnell, Los Angeles drilling contractor, has been awarded contract to drill a well on the Flickinger property at McKittrick for McDonald, Burns & Norris in 36-30s-22e.

Grubb & Hawkins are the drilling contractors for the Charles Sykes 1 Stafford, in C NW NE 24-7s-3w, Mobile County, Alabama. Operator was building derrick.

Loffland Bros., Tulsa, has contract to drill California Co. 1 McLaughlin-Government, SE NW 24-2n-103w, a Weber sand test on the Rangely structure in western Colorado. Location is 1¾ miles northwest of the same company's discovery well in the Weber of Pennsylvanian age.

J. Stewart Boyle, drilling contractor of Houston, has been awarded contract to drill the John Mayo 1 J. Thompson, a 6,500-ft. wildcat in Trinity County, southern part of East Texas, 7 miles north of Glendale. Test was to get started on August 15.

Ashby Drilling Co. has been awarded the drilling contract on the Gulf Refining Co. 1 Peter Payette, in NE NW SW 8-14n-6e, Bay County, Michigan.

E. M. Shields will drill on contract the Socony-Vacuum Oil Co., Inc., 2 Belly Achers, in C NW SE 14-12n-6w, Montcalm County, Michigan.

Clyde Miller has been awarded drilling contract on the Zan Oil Trustee 1 J. Westrate, in NE NE SE 34-6n-15w, Ottawa County, Michigan.

Charles Withers Drilling Co., of Moose Jaw and Vera, Sask., is drilling Vera Oilfields 4 in LSD 10, 36-41-24w3, near Unity, Sask., for Vera Oilfields, Ltd.

Robert A. Wallace and **Frank McDougal** have opened an office in Los Angeles for the Government Refining Co. of Oklahoma and despite the name will for the present engage in contract drilling in California fields where many locations are waiting for contractors.

Nicklos Drilling Co., Houston, has the contract for drilling 2 Paul Daigle, in the North Richie area of Acadia Parish, Louisiana, for Continental Oil Co. This test is scheduled to go to 8,650 ft.

Brown Drilling Co., Bakersfield, Calif., is the contractor on Standard Oil Co. of California 6-H Perry, 36-4n-2e, Sacramento County, which last week apparently discovered a deeper gas sand in the old Rio Vista field.

General Petroleums, Ltd., of Calgary, Alta., has derrick up for an exploratory well for Transcontinent Oil Co. in LSD 4, 36-18-3w5, on the Highwood uplift in the Alberta foothills south of Turner Valley. Objective is the Madison limestone around 1,800 ft.

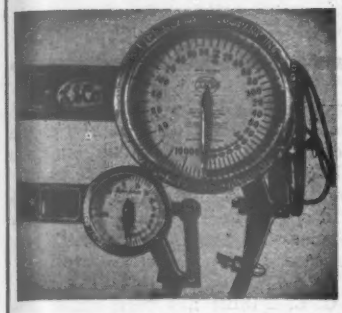
Snyder & Head, of Calgary, Alta., have rig up for a well to be drilled on the Duke of Windsor's E.P. Ranch west of High River, Alta.

O'Kane & Brain, California drilling contractors, have moved their operating address from Long Beach to Wilmington and while they will also do contract drilling in other fields they will undertake additional drilling in the Wilmington field.

Severns Drilling Co., Los Angeles, has been awarded contract for the drilling of another well for Tide Water Associated Oil Co. in the Buena Vista Hills field of Kern County, California, where the contractor recently finished a well for Tide Water Associated.

Richmond Drilling Co., Midland, Tex., plans to start a wildcat within the next month in the southwest corner of Section 34, Block M, EI&R Survey, in western Dawson County, Texas. Supporting the project are Magnolia Petroleum Co., Cities Service Oil Co., Hugh Corrigan, and R. A. Albaugh. The test, 2 miles north of Albaugh 1 Handley, is to go to 5,200 ft.

20 LINE SCALES to choose from



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RECTORSEAL
THE POSITIVE LEAK PREVENTER

OKLAHOMA

Possible New Pool in Pauls Valley Area

A new pool in the Pauls Valley area between the Pauls Valley and East Pauls Valley pools loomed as Ed Kubat et al 1 Dixon, NE SW SE 9-3n-1e, on drill-stem test at 3,521-29 ft. showed for an estimated 5,000,000 cu. ft. of gas and a spray of 46° gravity oil. The well has been killed and casing is being run.

In Stephens County, southwest of Marlow, Texas Co. 1 Bateman, SW NW NE 21-2n-8w, on drill-stem test showed gas and 1,100 ft. of light brown oil plus 70 ft. of fresh water.

Operations continue to pick up as 56 new operations were announced, including 11 wildcats, while completions for the week totaled only 23. There were 17 oil wells, 2 gas wells and 15 dry holes completed during the week.

The West Moore pool, previously outlined on the southwest and southeast and north by dry holes, had another disappointment when Mid-Continent Petroleum Co. Harris 1-B, NE NE NW 32-10n-3w, south offset to the discovery well, found water in the second Wicox. Sinclair Prairie Oil Co. 1 Theimer, NE SE SW 20-10n-3w, three-fourths of a mile north of production, which was dry in the second Wilcox, failed to get production in a Simpson test and was backing up, preparing for a test of the Bois d'Arc section of the Hunton after acidizing.

The West Edmond field had a crop of wells completing or near completion, but no extensions among them. However, Phillips Petroleum Co. and Carter Oil Co. announced a location for a wildcat test in SE SE 28-16n-5w, Kingfisher County, 6½ miles north and 4½ miles west of the nearest production, on acreage recently acquired from the Kerlyn Oil Co.

OKLAHOMA WILDCAT COMPLETIONS

Coal County: Amerada 1 Roy Wood, SW NE SE 17-1n-8e, dry, TD 5,820 ft., McLish 5,175 ft., basal McLish 5,529 ft., Oil Creek 5,608 ft., Oil Creek sand 5,800 ft.

Creek County: Fred Haddock et al 1 Sarvie, NE SW SE 11-18n-9e, dry, TD 3,026 ft., Viola 2,987 ft., Wilcox 2,990 ft.

Sinclair Prairie 1 Watson, SW NE SE 34-15n-7e. Discovery. Flowed 230 bbl., 43° gravity, pay zone 2,619-38, TD 3,970 ft., PB 2,650 ft., Prue 2,616 ft., Viola 3,892 ft., Wilcox 3,932 ft., second Wilcox 3,947 ft.

Skelly 1 Dial, SE NE SE 36-14n-7e, dry, TD 4,120 ft., Wilcox 4,069 ft., second Wilcox 4,100-20 ft.

Garfield County: Ace Gutowsky 1 Lee, SW SW 18-24n-5w, dry, TD 5,938 ft., Bartlesville 5,405 ft., Mayes 5,720 ft.

Garvin County: Magnolia 1 C. Ross, NE SE NW 19-3n-2e, dry, TD 3,405 ft., Sylvan 3,095 ft., Ferndale 3,135 ft., Trenton Viola 3,190 ft.

Hughes County: Texas 1 Nichols, SE SW SW 33-9n-10e, dry, TD 3,950 ft., Hunton 3,833 ft.

Noble County: J. P. Morgan 1 Devane, NW NW SW 17-24n-1e, dry, TD 2,733 ft., Endicott 2,660 ft.

British-American 1 School Land "F," SE NE NW 13-21n-3e, dry, TD 4,270 ft., Wilcox 4,249 ft., second Wilcox 4,258 ft.

Pittsburgh County: Public Service 1 Horton, SE NW NW 19-7n-13e, 1,000,000 cu. ft., TD 2,552 ft., Hartshorne 2,369 ft.

Stephens County: Anderson-Pritchard 2 Woods, SE NW SE 26-2s-7w, dry, TD 1,980 ft.

Magnolia 1 L. L. Humphreys, NE SW SW 31-2s-4w, TD 311. Lost bailer, junked hole. Skid 25 ft. south for new location.

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Foreign:
GEORGE R. WOODS, 17 Battery Place, New York, N. Y.

PERSONALS

Rouse Grew Up in West Virginia Oil Country

JACKSON W. ROUSE, driller and drilling foreman at Wickett, Ward County, Texas, for Gulf Oil Corp., grew up in the West Virginia oil country when it was making history, so it came about quite naturally that at 16 he got a job as roustabout and pumper for Melrose Oil & Gas Co. at Sistersville. He has been in oil work ever since.

From 1903 until 1919 young Rouse was employed most of the time by South Penn Oil Co., first as a tool dresser and at 29 as a driller. In 1919 South Penn transferred him to New Domain Oil Co., at Cisco, Tex., as a driller for contractors in the Breckenridge field.

In 1923 Rouse joined Gulf as a driller, and during the next 3 years he worked on wildcat wells in Archer, Hutchinson, Ward, Crockett, Pecos, and Crane counties. From 1926 to 1932 he was employed by Gulf as driller and drilling foreman at Borger and Pampa, and during the succeeding 2 years he was drilling in Crane County, Texas. He has been filling his present position for the past 10 years. Rouse was born in 1883 at Cairo, Ritchie County, West Virginia.

B. E. Moir has been promoted by The Atlantic Refining Co. from district superintendent for the East Texas pool to a new position as chief petroleum engineer in the engineering and operating department, with headquarters in Dallas. He is succeeded as district superintendent by Thomas C. Frick, formerly job analyst for the southwestern states. **Dewey A. Jordan** has been promoted from district superintendent of West Texas and New Mexico to a new position as superintendent of drilling and production in the engineering and operating department, with headquarters in Dallas. **Lee Hays,** formerly assistant district superintendent, has been advanced to district superintendent, with headquarters in Odessa, taking Jordan's former post.

George J. Hanks, Bradford, Pa., vice president of South Penn Oil Co., was advanced to the presidency at a meeting of the board in Pittsburgh last week. He succeeds Noel Robinson, who died recently. Hanks resigned as vice president and director of Tide Water Associated Oil Co. last May, after 30 years' service with that organization, to join South Penn. He withdrew at the same time as president and manager of Tide Water Pipe Co., Ltd., and Tidal Pipe Line Co.

A. L. HOOPER

A. L. Hooper will return to the Houston office of The Texas Pipe Line Co. after a leave of absence of more than 2 years, during which he served as chief of right-of-way and claim department in the Cincinnati office of War Emergency Pipelines, Inc. Under his supervision the right-of-way was purchased and damage claims completed for both the big inch and little big inch in record time. **Harold I. Putnam,** formerly division supervisor for War Emergency Pipelines, at the Lancaster, Pa., office will assume the position vacated by Hooper.

Bert H. Lincoln, chief chemist for Continental Oil Co., who was injured in an automobile accident in New York 3 weeks ago, was reported to be on the road to recovery, with likelihood, however, of a protracted absence from his office.

Park J. Jones, who acquired his experience with The Texas Co. on production in California, New Mexico, West Texas, Central and South Texas, Louisiana, Oklahoma and Illinois, has opened an office as production consultant in Houston. He will specialize in technical advisory services to producers of oil, condensate, gas and natural gasoline.

C. E. Dahlke has been made general sales manager of Allied Oil Corp. and has moved from St. Elmo, Ill., site of the company's refinery, to Chicago, executive headquarters. He succeeds **William Quottrocchi,** who resigned.

George F. Russell, for the past 5 years in the natural-gasoline division of Phillips Petroleum Co., has been appointed assistant professor on the chemical engineering staff of University of Oklahoma. Professor Russell has devoted his attention largely to problems related to fractionation of petroleum and dehydration of natural gas, and he is continuing research in these two engineering fields.

D. C. Fleming, manager of the Wichita division of Skelly Oil Co., has been named chairman of the Kansas petroleum conservation committee for District 2, Petroleum Administration for War. He formerly was cochairman, and he takes the place of **Lane Dunagin,** president of Kansas Oil Men's Association, who resigned. **Fred Kistler,** of Kistler Oil Co., Coffeyville, succeeds Fleming as cochairman.

Maj. Gen. Harry H. Johnson, Texas oil man, has been relieved of his post as military governor of the Rome area in Italy to accept an "important assignment with troops." He was awarded the Legion of Merit for "reestablishing the economic and political structure in Rome in the shortest possible time after the city's fall." He received also the Grand Cross of the Order of the Crown of Italy, bestowed on behalf of Prince Umberto. At the time he was called to military service General Johnson was assistant to **Walter B. Pryon,** vice president of Gulf Oil Corp., Houston.

MARKET QUOTATIONS

Prices as of August 15, 1944

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gal.

REFINERY GASOLINE

Octane (A.S.T.M.):	80†	72-74
Mid-Continent	6.00-6.25	5.750-6.000
Gulf Coast	6.00-6.50	‡5.750-6.250
Northeast Coast	9.80	9.200
California		8.255-8.500

*Basis Oklahoma Group 3, †1939 C.F.R. (research method.) ‡Unleaded.

NATURAL GASOLINE

Grades:	25-70	10-55
Oklahoma (Group 3)	6.75¢	5.70¢
North Texas	4.37½	5.25¢
North Louisiana	4.37½	5.25¢
California	4.87½	5.50¢

CRUDE-OIL PRICES

Representative posted schedules per bbl.

East Texas	$1.25
Conroe	1.43
Tepetate, Louisiana	1.18
Illinois basin	1.37
Pecos County, Texas	.95
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.08

Note: Exclusive of subsidy.

A.P.I. REFINERY REPORT

Week ended August 5, 1944

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gasoline	Stocks: Residual	Stocks: Gas oil
Appalachian	137	3,464	483	930
Ind., Ill., Ky.	780	18,017	4,286	5,695
Okla., Kan., Mo.	366	8,879	1,504	1,723
Censored area*	2,366	36,285	17,070	21,213
Rockies	110	2,233	648	352
California	770	14,123	32,764	9,497
Total 8- 5-44	4,529	80,801	56,755	39,410
Total 7-29-44	4,627	82,665	56,280	38,135
Total 8- 7-43	3,810	71,927	67,091	34,414

*Reports combined on East Coast, Texas Gulf Coast, Louisiana-Arkansas and Inland Texas at request of PAW.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
August 5, 1944	222,931,000
July 29, 1944	225,112,000
August 7, 1943	237,382,000

*Excludes unrefinable California stocks.

CALENDAR

September

A.C.S., 1944 fall meeting, Pennsylvania Hotel, New York, September 11-15.

N.P.A., annual meeting, Hotel Claridge, Atlantic City, N. J., September 20, 21, 22.

October

I.P.A.A. board of directors, Dallas, Tex., October 9-11. (Takes place of anniversary meeting previously scheduled.)

C.N.G.A., annual meeting, Biltmore Hotel, Los Angeles, October 13.

November

A.C.S., third national chemical exposition, Coliseum, Chicago, November 15 to 18.

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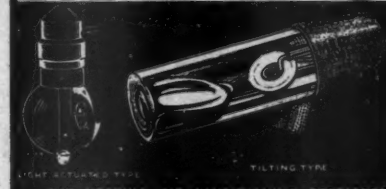

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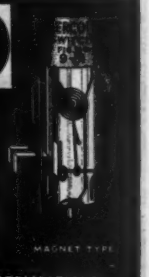

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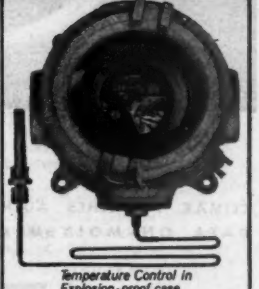

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DA (Double Adjustment) Temperature or Pressure Controls are used extensively on industrial applications. The outside double adjustment facilitates the control operating range setting. The calibrated dial plainly indicates the desired setting. All guesswork is eliminated. No cover to open or remove when making control adjustments. A locking device is provided to prevent tampering. Various ranges available.

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See catalog No. 600 for complete information on all types of Mercoid Controls.

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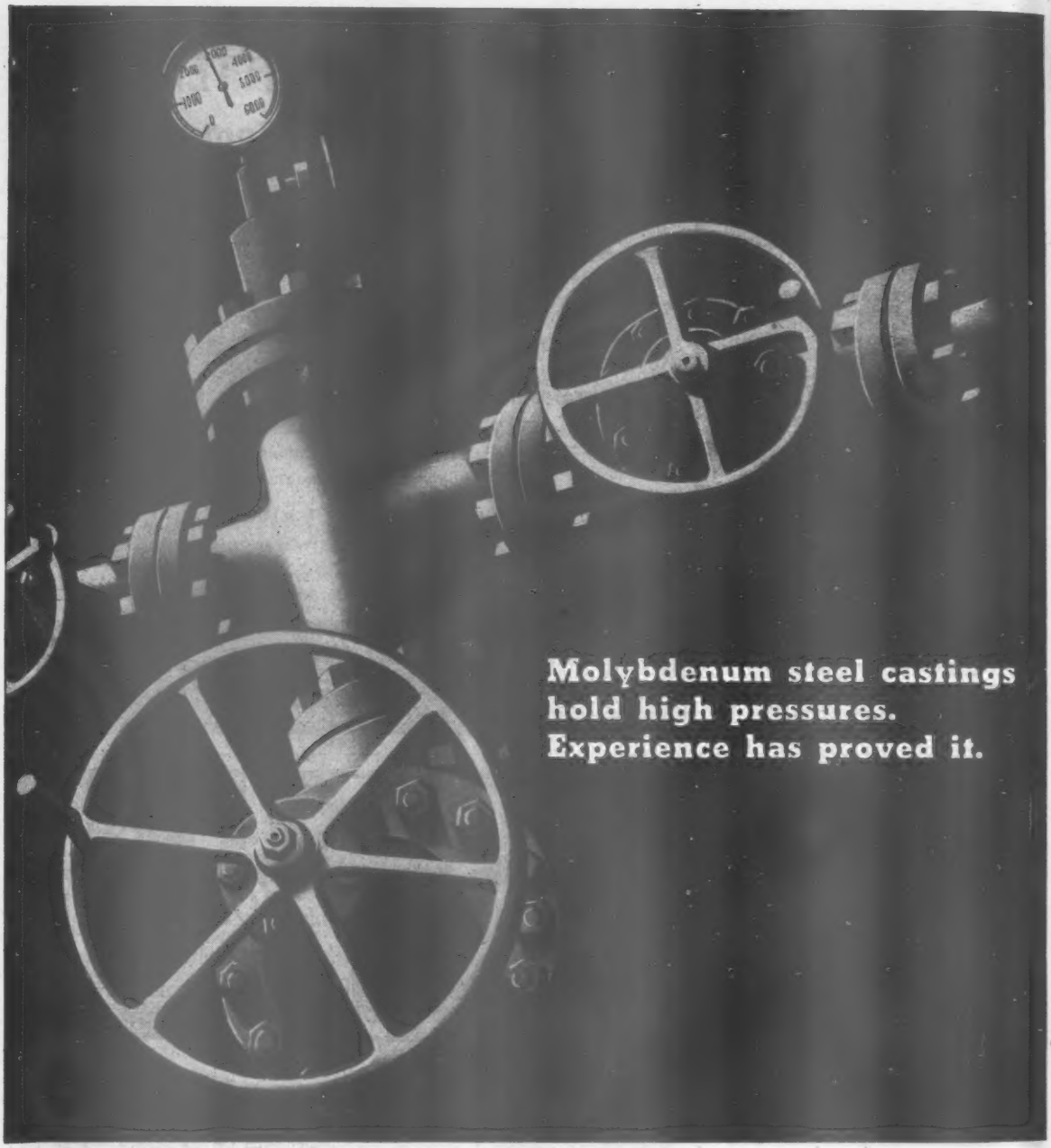

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MOLY

Equipment Progress

Norton Co. Forms New Sales Territory

Norton Co., Worcester, Mass., announces the formation of a new sales territory to be known as the West Central Rocky Mountain district. It will be under the supervision of Ralph O. Anderson as district manager with headquarters in Denver. Anderson has been with Norton Co. over 30 years and for a considerable time was district manager in Pittsburgh.

F. L. Anderson, G. W. Thomson, and G. L. Freeman with headquarters in Kansas City, Dallas, and Houston, respectively, will report direct to R. O. Anderson who is responsible to W. E. Shumway, sales manager, western region.

Bristol Opens Branch Office in Houston

The Bristol Co., Waterbury, Conn., manufacturers of automatic control and recording instruments, has opened a new branch office in Houston, which will serve Louisiana and Texas with the exception of the Panhandle section. D. D. Ault, who has been resident sales engineer in Houston for a number of years, will be in charge of the new office.

New Athey Vice President

B. F. Lease, sales manager of Athey Truss Wheel Co., Chicago, was elected vice president in charge of sales, advertising and service at a recent meeting of the directors.

Iverson Tool Co. to Distribute Continental Engines

Continental Motors Corp., Muskegon, Mich., announces the appointment of Iverson Tool Co., Tulsa, as a distributor of Continental Red Seal engines.

Baum Named Plant Supt. Of Duraloy Co.

Jesse J. Baum, until recently process engineer and metallurgist with Allison Engineering Division, General Motors Corp., has joined Duraloy Co., Scottdale, Pa., as plant superintendent. Baum's previous connections were with National Alloy Steel Co., Ohio Steel Foundry Co., Universal Cyclops Corp., and Ingersoll Steel & Disc, division of Borg Warner Corp.

Empire Oil Field Machinery Co. Organized by Payte And Schabarum

Empire Oil Field Machinery Co. has been organized by Don F. Payte and B. R. Schabarum with headquarters at Odessa, Tex. A modern machine shop is designed to handle all kinds of welding and machine and repair service on drilling and production machinery. The company also handles second-hand machinery and some specialized lines of new equipment. The company is a partnership, both members of which have been employed by National Supply Co. in the machinery end. Payte became sales manager of the Tulsa division and Schabarum of the Fort Worth division.

Chain Belt Co. Establishing Office in Tulsa

Chain Belt Co., Milwaukee, is transferring its oil-field-products divisional offices from Houston to Tulsa.

District offices have been established at 206 Kennedy Building, with William Watson, formerly of the Houston offices, in charge as district manager.

Bell Appointed Technical Service Engineer for Hycar Chemical Co.

Frank E. Bell has been appointed technical service engineer for Hycar Chemical Co., producer of synthetic rubber from butadiene, it is announced by Frank M. Andrews, general sales manager for the company. Bell, who has had 13 years' experience in the rubber industry, comes to Hycar from the Barrett division of Allied Chemical & Dye where he was employed 4 years as technical service representative.

Moorlane Co. to Receive Army-Navy "E"

The Moorlane Co., Tulsa, subcontractor on the Army's celebrated portable pipe line, has received notification that it will receive the Army-Navy "E" award, according to W. D. Moorer, president of the firm. Arrangements are being made for a ceremony of award, at which time the company will raise the burgee, and employes will be given lapel pins.

Henderson Heads Oil-Field Sales For Western Gear Works

Glenn E. Henderson has been appointed to head the sales and service of oil-field equipment manufactured or serviced by Western Gear Works, assuming the duties of William G. Corey, who recently opened an engineering consulting office, though keeping his association with Western Gear Works. Prior to his new post, Henderson had been in the sales division of the company for several years, and associated with the oil industry in California for the past 24 years.

Mid-Continent Supply Co. Exclusive Regan Representative in Area

Regan Forge & Engineering Co., San Pedro, Calif., has appointed Mid-Continent Supply Co. as exclusive representative in the Mid-Continent for the entire Regan line of oil-field drilling equipment. For several years the supply company has handled Regan products and under the terms of the agreement will now increase the service to cover all of the Mid-Continent.

Talon, Inc., Promotes Two

Robert A. Campbell, sales manager, Talon, Inc., Steel Tube Division, has been appointed general manager. He will continue to direct the sales activities in addition to his new duties. John Farrimond has been named superintendent of finishing departments.

Koeppen Returns to Southwest For Timken Axle

Robert L. Koeppen, a veteran of 25 years with Timken-Detroit Axle Co., has returned to the southwest as regional field service representative for Timken in California, Arizona and New Mexico. He will make his headquarters in Los Angeles. This territory was recently covered by Herman F. Zarnikau until his death on June 1.

Jones & Laughlin Steel Corp. Makes Changes In Sales Organization

D. J. Gent, who has been resident manager of sales at Dallas for Jones & Laughlin Steel Corp., has been transferred to the Detroit district sales office. He will be succeeded by D. M. Griffith who is being transferred from the Atlanta district sales office. E. A. Toothaker, who has been resident salesman in Denver, has been appointed resident manager of sales of the Denver suboffice.

Hyster Announces Personnel Changes

Eugene Caldwell, vice president of Hyster Co., Portland, Ore., has announced three personnel changes which go into effect immediately.

W. B. Morrow, formerly personnel manager, will head up a new department of confidential nature. Cliff Dunham, who has been in charge of the Chicago office, becomes personnel manager. Donald Foster, of the Portland purchasing department, will go to Chicago as office manager.

American Locomotive Appoints Three

The executive committee of the board of directors of American Locomotive Co. has announced the following appointments: Perry T. Egbert, vice president in charge of diesel locomotive sales; William S. Morris, vice president in charge of steam locomotive and divisional sales and James D. Vaughan, comptroller.

Trade Literature

Seismograph Service Corp. of Delaware, Tulsa.—Booklet on the Seisdel Well Logging Service, a method of logging wells by mud analysis during drilling.

The Marley Co., Kansas City, Mo.—Bulletin 700-A, illustrating typical installations of double-flow horizontal induced-draft cooling towers. The booklet, of 34 pages, is handsomely printed in color.

Elgin Softener Corp., Elgin, Ill.—Bulletin 606, which describes the improved "Double Check" design Elgin zeolite water softener.

Aldrich Pump Co., Allentown, Pa.—Bulletin 50, a 60-page illustrated volume prepared for engineers concerned with pumps and hydraulic equipment. It contains complete and authoritative hydraulic information and tables. A second section is devoted to Aldrich manufacturing facilities, and a third is a condensed catalog of the company's pumps and hydraulic equipment.

Rocky Mountain Area

(Continued from page 132)

Test at Fourbear.—Honolulu Oil Corp. 3 Unit, SW NW SE 20-48n-103w, Fourbear structure, west side of the Big Horn basin, is spudding for a test to the Tensleep. Location is ⅛ mile north of a well completed 15 years ago which made 375 bbl. initial from the Tensleep at 3,260-78 ft. There was no market for black oil at the time and the well was shut in.

Tops on Lance Creek deep test.—Superior Oil Co. has released the tops on its deep test in Lance Creek in 1-A Ong, C SE SW 31-36n-65w, which was drilled to 10,910 ft. and abandoned a few months ago. It was located just across a fault on the west flank. It had the top of the Dakota at 8,606; first Sundance, 9,130; basal Sundance, 9,270; Converse, 10,058; first Leo, 10,620; second Leo, 10,822. Continental's 10 Rohliff, in the 40 to the east, had the top of the first Leo at 5,373 ft., and was completed for 1,894 bbl. In this short space interval the first Leo proved to be more than 5,200 ft. deeper.

WYOMING WILDCAT COMPLETIONS

Fremont County: Poison Creek, Stanolind 1 State, NE NE SW 16-27n-93w, TD 4,100 ft., dry in Tensleep.

COLORADO WILDCAT COMPLETIONS

Rio Blanco County: White River, Frontier Refining 1 Government, CSL NW NW 32-2n-96w, TD 7,005 ft., PB 5,928 ft., completed in Mesa Verde sands as gas well, quantity not reported pending regaging. Top Mesa Verde 5,560 ft.

MONTANA WILDCAT COMPLETIONS

Musselshell County: Gage, Carter Oil 1 State, NW SE 16-9n-26e, TD 5,986 ft., some dead oil, no live oil saturation, dry.

Pondera County: Midway, R. C. Tarrant 1 Bouma, NE NE NE 31-28n-1w, TD 1,710 ft., Sunburst 1,681-1,709 ft., water 1,704-09 ft., shot 70 qt. 1,690-1,704 ft., 15 bbl. first 24 hours, some water.

West Conrad, Carter Oil 1 Warwick, SE SE 14-28n-4w, dry, TD 2,667 ft., top Ellis 2,465 ft., top Madison 2,645 ft., sulfur water 2,645-57 ft.

NORTHWEST NEW MEXICO WILDCAT COMPLETIONS

San Miguel County: Palma, Bond D. Jones 1 Jones, SE SW 13-15n-17e, dry in granite at 1,231 ft.

Permian Basin, Panhandle

(Continued from page 126)

tion. Superior Oil Co. of California 1 Wheeler, east outpost on the north edge of the Wheeler field, topped the Ellenburger by samples at 10,660 ft., showed sufficient oil and gas on drill-stem tests at 10,655-10,714 ft. to assure production, and was coring ahead.

Ector County.—Shell Oil Co., Inc., and Cities Service Oil Co. 1 TXL, projected 11,000-ft. wildcat in western Ector County, Section 7, Block 45, T-1-S, T&PRR Survey, is reported to have made a drill-stem test at 7,073-82 ft., open 45 minutes, recovering 270 ft. of live oil, 630 ft. of salt water, and 300,000 cu. ft. of gas. It was drilling ahead below 7,675 ft. in lime.

Pecos County.—Humble Oil & Refining Co. 1 State National Bank of El Paso, wildcat near Baldridge, Section 7, Block 140, T&St.LRR Survey, tried to blow out at total depth of 5,449 ft., showing high-gravity oil on pits, and was weighting up mud to keep it under control. It probably is in the Ellenburger.

New wildcats announced in the district during the past week included Seaboard Oil Co. 1 Frank M. Weaver, 9 miles west of Lamesa, in Dawson County, a 5,500-ft. test; Seaboard 1 Lula Mae Cravens, Lubbock County, 9 miles north of Lubbock, a 6,000-ft. test; and Brown & Brown et al 1-A Caldwell, Howard County, 15 miles north of Big Spring, 6,000-ft. test.

WEST TEXAS WILDCAT COMPLETIONS

Andrews County: Texas 1 A. W. Pattillos, SW SW 22-A-36, PSL, shot 420 qt. 4,280-4,380 ft., IP 72 bbl. day, TD 4,414 ft., elev. 3,218 ft., anhydrite 1,750 ft., Yates sand 2,820 ft., Yates FG 2,850 ft., brown lime 3,880 ft.

Gaines County: Bay Petroleum 1 B. Cox et al, Sec. 468, Blk. G, CCSD&RGNG Sur., dry, TD 5,223 ft., elev. 3,482 ft., anhydrite 1,940 ft., Yates 3,070 ft.

Howard County: Stanolind 1 John W. Davis, 330 ft. out SE cor. 43-30-1n T&P, 234 bbl. day through 2-in. tubing, top of pay 2,285 ft., elev. 2,379 ft., TD 2,642 ft.

PANHANDLE

AMARILLO.—Humble Oil & Refining Co. is moving in materials for a 6,000-ft. wildcat, 1 Pronger Brothers, SE NW Section 317, Block 1-I, T&NORR Survey. In Oldham County, Stanolind Oil & Gas Co. 1 Herring plugged back to 4,800 ft. because of losing returns at total depth 6,307 ft., and will redrill.

SOUTHEAST NEW MEXICO

HOBBS.—Phillips Petroleum Co. is starting an 8,000-ft. Ordovician test at 4 Lea-Mex, SW SW 17-17-33, in the East Maljamar area of western Lea County. Humble Oil & Refining Co. 1 Federal-Leonard Oil Co., southeastern Lea County, was drilling at 11,429 ft. in sandy shale.

SOUTHEAST NEW MEXICO WILDCAT COMPLETION

Eddy County: Martin Yates et al 1 Stebbins, SW SW 29-20s-29e, 5,700,000 cu. ft. gas, TD 931 ft., PB 730 ft., lime, top of pay 710 ft.

USED PIPE & DRILLING EQUIPMENT FOR SALE

1—Allis-Chalmers, model E, tubing & rod machine, completely overhauled, 4 excellent rubber tires, with large single drum.
1—1 set rubber rig-o-lite, excellent condition.
1—complete Wax. power rig, less drill pipe, for 4000 ft. drilling, good running condition. — We will be glad to send an inventory. Swivels from 300 ton to 50 ton, overhauled and ready for service, Ideal and Emsco.
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60,000 ft. 6⅝" (6" line pipe) 19# T & C Range I.
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100,000 ft. 2" plain tubing T & C 4.50#, make excellent line pipe—2,500# test.

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